Pit and Quarry
With which is consolidated
CEMENT-MILL & QUARRY

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Two New Plants Make Roquemore Gravel Company South's Largest Sand and Gravel Producer

Dredge and Dragline Operations Good Examples of Best Modern Practice

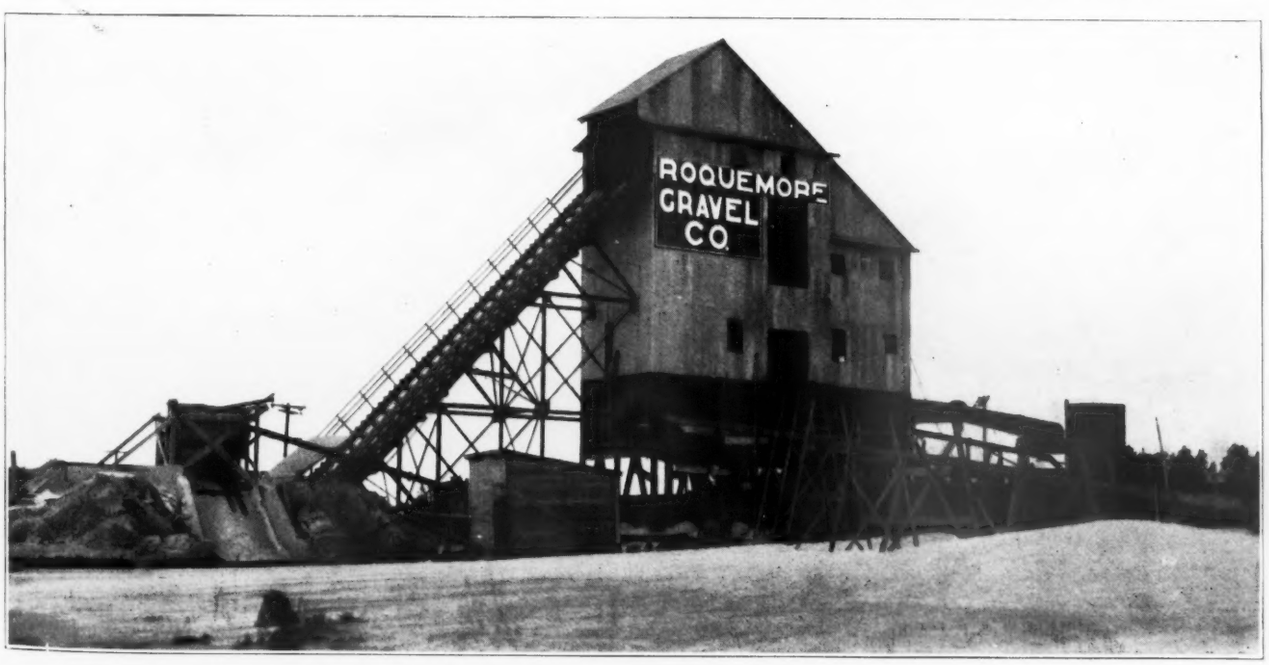
BY W. E. TRAUFFER

THE Roquemore Gravel Company of Montgomery, Ala., operates three of the most modern sand and gravel plants in the South. The oldest of these, which incidentally is the largest plant in the South, has been in operation about four years, while the other two are each about a year old. Each has the latest types of equipment. The product is distributed over a wide area in Alabama, Georgia, Florida, Mississippi and Louisiana.

The Flomaton Plant

The newest plant of the Roquemore Gravel Company in Florida is just across the line from and a mile south of Flomaton, Ala. The plant, which is of all-steel construction and concrete foundations,

Main revolving screen at Flomaton plant



Flomaton plant, showing sump at left

Close-up of Flomaton plant, showing overflow from sump

was designed by F. M. Welch, head of the F. M. Welch Engineering Service. It went into operation in September, 1928 and has a capacity of about 80 cars per day.

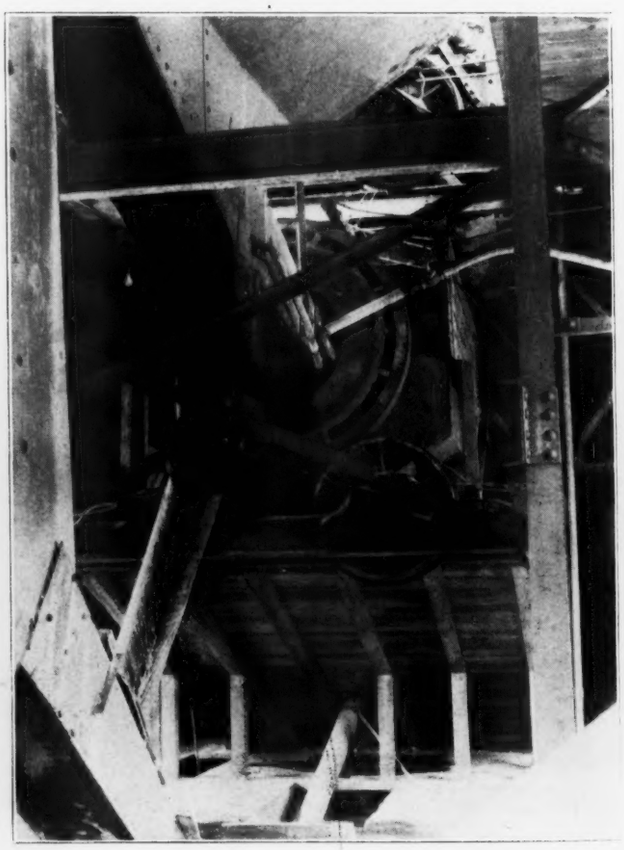
The property on which the plant is located consists of about 500 acres, all of which contain sand and gravel. The deposit averages about 50 ft. in depth with an overburden varying from nothing to 4 ft. It contains about 40 per cent gravel, of which none is over 1½ in. in size. The gravel differs from that in Montgomery in having a high percentage of quartz. The sand is a mixture of fine and coarse.

The new dredge, which went into operation recently is of the standard Greenville type made by the Greenville Manufacturing Company. It has an

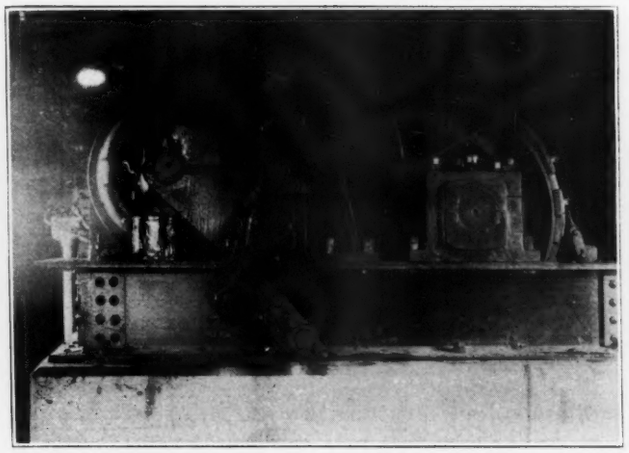
Pump and motor furnishing wash-water at Flomaton plant

Concrete sump into which dragline discharges at Flomaton plant, with overflow at left

end intake and side discharge. The super-structure is of structural steel with corrugated siding and roofing and the single compartment hull is 26 ft. wide by 76 ft. long, with a ladder well 20 ft. long and 12 ft. wide. The nozzle ladder has an American Manganese Steel Company rotary cutter head. The ladder is supported from a 50 ft. steel boom. A 5-drum hoist driven by a 30-hp. variable speed motor handles the boom on one drum, and two shorelines, and the two spuds at the rear corners of the dredge on the others. It is equipped with a solenoid brake and is remotely controlled from the operator's seat at the front of the dredge.



Revolving sand screen at Flomaton plant



Hoist operating skip-cars at Flomaton plant

Switching cars at Flomaton plant

The 15-in. Amsco bottom discharge dredge pump is driven through a Francke flexible coupling by a 400-hp. variable speed motor. There is a standard full marine type water-cooled thrust bearing between the coupling and the pump. Two Chisholm-Moore 2-ton cyclone overhead cranes over the dredge pump at right angles to each other, handle repair parts. Other miscellaneous equipment on the dredge consists of a Worthington 3-in. centrifugal pump driven by a 3-hp. Western Electric motor, which pumps the bilge water out of the hull and two American Engine Company hand-operated capstans.

The dredge line consists of Youngstown Sheet and Tube Company cast-iron pipe connected with Goodyear rubber sleeves, supported on standard Greenville steel pontoons. At the shore end, it discharges into a wooden hopper where stationary screens divert about half of the sand back into the

Drive end of a secondary screen at the Montgomery plant. Steel chute, above, from main screen

View north from Alabama Sand and Gravel plant. Pumphouse in middle distance is normally on river bank

Old Montgomery plant from south

Pump in temporary location at the Montgomery plant

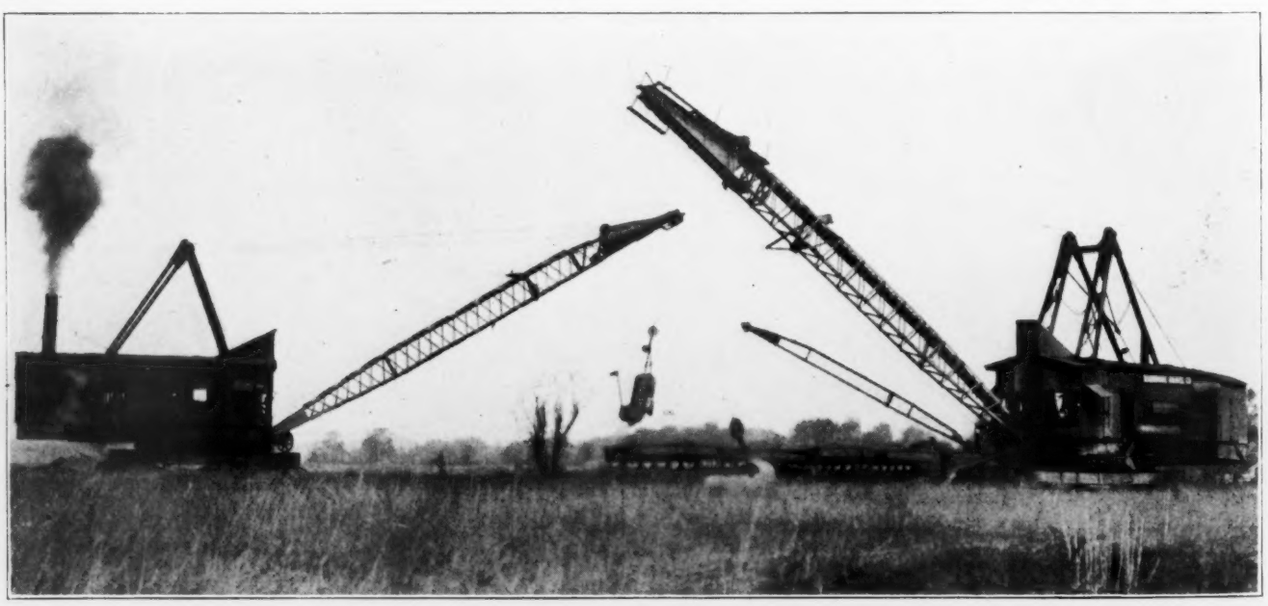
Dumping car into track hopper at Montgomery plant

pit. The material passing the screens discharges into a circular concrete sump which dewaters the material before it goes to the plant. A 4-in. Allis-Chalmers pump keeps the pit free of water.

The sump discharges through Curtis air-operated gates into the 4-cu-yd. capacity steel cars on the Greenville balanced type skip hoist. The hoist is located on a concrete foundation and in wood frame building on the opposite side of the plant from the incline, the cables running over the top of the plant under the roof. This arrangement causes only a vertically downward stress on the building due to the skip operation. The hoist is of the single-drum Greenville type direct-gear driven by a 100-hp. motor mounted on the same steel base with the hoist. It is equipped with solenoid brakes and is controlled by the operator of the skip at the top of the plant. Both cables are wound in reverse directions on the same drum so that one car is raised while the other is lowered.

The skip cars discharge into a 50-ton capacity steel bin on the top floor of the plant. The bin discharges through a lever operated gate into the Greenville primary revolving screen. The main jacket is 5 ft. in diameter by 23 ft. long with two outer jackets and separates the material into four sizes, three of which go direct to the bins. The screen is driven through belt and spur gears by a 40-hp. motor. The fourth size goes to a Greenville sand screen which separates into two sizes of sand. This is driven by a 20-hp. motor.

The material is thoroughly washed during every operation by sprays in the chutes and screens. The overflow is carried away in a steel flume. Wash-



Three draglines at Montgomery plant, one in background loading cars

One of the main screens at the Montgomery plant

ing water is furnished by an Allis-Chalmers 8-in. by 6-in. single stage centrifugal pump with a capacity of 2,000 g.p.m. against a 70-ft. head. It is driven by a 50-hp. Allis-Chalmers motor. The pump is located in the skip hoist house and secures its water from a nearby pit. Air for the Curtis skip gates is furnished by an Ingersoll-Rand 5-in. by 4-in. air compressor driven by a 7½-hp. Westinghouse motor. This is located on the screening floor of the plant.

Storage and Shipment

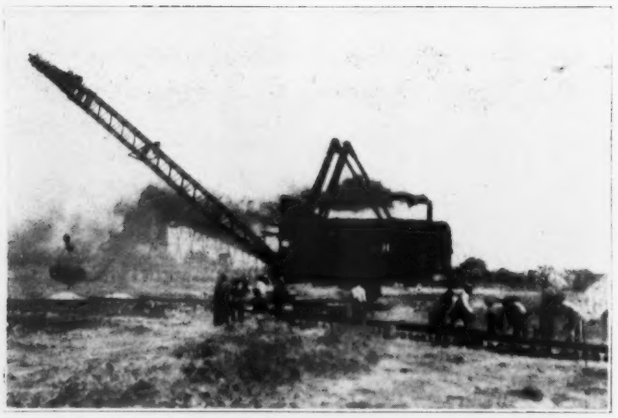
The five steel bins under the plant have a total capacity of about 5 cars. They discharge into cars on three tracks for shipment. There is also a run-around track for car storage. A 45-ton Baldwin steam locomotive does all of the switching and hauls the loaded cars a mile over the company's sidetrack to the L & N yards at Flomaton.

Shipments are made to Pensacola, Fla., Selma, Montgomery and Mobile, Ala., a territory extending over 100 miles in all directions being served over the Frisco and L & N railroads.

Debris left about dragline, north side of Montgomery plant

Water for the locomotive is pumped from one of the dredge pits to a steel water tank by a small Dayton-Dowd centrifugal pump driven by a 2-hp. Westinghouse motor. A Crouse-Hinds searchlight is used to signal to the dredge operator from the

Montgomery plant from south, showing the loading of cars



Gang laying new track at Alabama Sand and Gravel plant. Dragline in background

plant. A Bucyrus 50-B steam caterpillar crane handling a 1½-yd. Page bucket as a dragline and a 1½-yd. Williams clamshell bucket when used as a crane does all of the stripping and any rehandling necessary. It was also used in the installation of the new dredge. A small office also includes a complete outfit for testing sand and gravel.

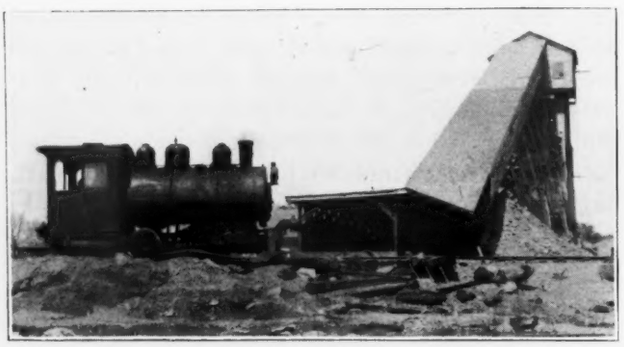
The structural steel framework of the plant was fabricated and erected by the Ingalls Iron Works and the corrugated siding and roofing and the rails on the double incline by the Tennessee Coal, Iron and Railroad Company. All electrical equipment and motors not otherwise noted were made by the General Electric Company.

Alabama Sand and Gravel Plant

The Alabama Sand and Gravel Company which was taken over as a subsidiary by the Roquemore Gravel Company in July, 1928 is the oldest operating company in the district. Its property is located about 10 miles north of Montgomery on the bank of the Alabama river. About 700 acres had been worked by the dredging method up to two years ago when an additional 1,000 acres of land, bordering on the old property were acquired.

The old operations were later abandoned and a new plant built which went into operation in March 1928. This plant was originally equipped with vibrating screens but when it came into the hands of the present owners revolving screens were installed. The capacity of the plant is now about 100 cars of graded and washed gravel per day as well as a considerable amount of pit run material which is sold as ballast.

Before operations were begun, a number of test holes were sunk to determine the quality of the deposit. It averages about 5 per cent gravel, practically all of which is under 2½ in. so that no crushing is necessary. The overburden of sandy clay is about 10 ft. thick and the deposit averages about 25 ft. in depth. Stripping is done by two Bucyrus draglines equipped with 4-yd. Page buckets which pile the overburden to one side to be rehandled later. These draglines operate 24



Locomotive furnishing steam to unwater track-hopper at Alabama Sand and Gravel plant

hours a day, stripping at night and excavating gravel in the daytime.

The gravel is loaded by the draglines into trains of Western 12-yd. side-dump cars which are hauled to the plant, a distance of about 1,000 ft. by two Porter 16-ton saddle tank locomotives. The cars are dumped at the plant into a concrete track hopper which feeds through a sliding gate onto a 30-in. inclined conveyor to the top of the screening building. The conveyor is on 255-ft. centers and is driven at its head pulley through a double Link-Belt silent chain drive by a General Electric 100-hp. motor. An automatic clutch on the drive prevents reversing of the loaded conveyor in event of power failure or breakdowns.

Alabama Sand and Gravel plant from west, showing floodedpit, dragline, and washed-out track. Note lines indicating flood levels

Stripping with dragline at Montgomery plant. Overburden is dumped into pit where gravel has been removed

The conveyor discharges into a steel-lined wooden chute which feeds an extra-heavy Greenville Manufacturing Company 5-ft. by 20-ft. revolving screen with a 6-ft. scrubber section, a 6-ft. 6-in. by 11-ft. inner jacket and a 7-ft. 10-in. by 9-ft. 6-in. outer jacket. This screen is belt and gear driven by a 30-hp. Westinghouse motor. It divides the material into four sizes, three of which go by chutes directly into bins under the screens. These sizes are 2½- to 1¼-in. road gravel, 1¼- to ½-in. concrete gravel, ½- to ¼-in., and ¼-in. down. Gates are so arranged that the ½- to ¼-in. size can be diverted into either the road or concrete gravel bins. Jets of water inside the scrubbing section of the screen give the material a thorough washing.

The material passing through the ¼-in. outer jacket of the screen goes to a sand hopper which feeds onto a sloping stationary screen with ⅛-in. mesh Tyler wire cloth. Jets of water here give a further washing and carry all dirt and foreign matter into a flume to the river. The material passing through this screen, sand, goes into the third wooden bin. Each of these bins has a capacity of 140 cu. yd. The material too large for this screen, pebbles, goes outside of the building to a concrete bin with a capacity of 60 cu. yd. The stone over 2½ in. drops out of the end of the screen into a chute leading to a waste pile.

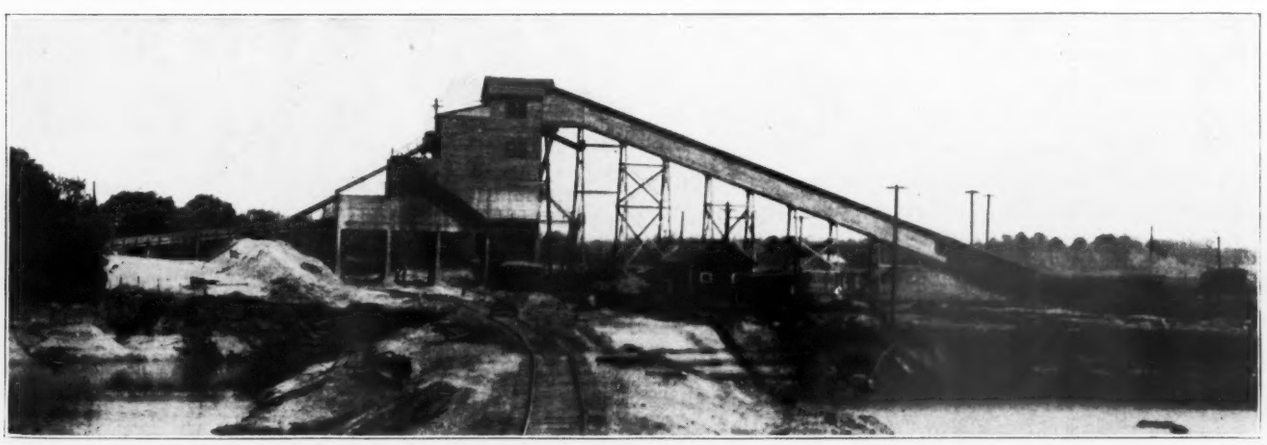
The bins discharge into railroad cars on four tracks under the bins. A special type of butterfly valve under the sand bin prevents leakage when shut. A 75-ton Brooks steam locomotive and a Rogers 45-ton locomotive do all switching and deliver the cars over a 3-mile private switchtrack to the Lackawanna and Northern and the Mobile and Ohio railroads over which the output is distributed.

A Brown Hoisting Machinery Company locomotive crane handling a Blaw-Dreadnaught 1¼-yd. clamshell bucket unloads coal from cars and loads the locomotive tenders and the 12-yd. cars which supply the draglines. A well equipped machine shop handles most of the repair work.

Discharge end of screen at Alabama Sand and Gravel plant

Washing water is ordinarily furnished by a Worthington 10-in. centrifugal pump, driven by a 300-hp. General Electric motor, located on the bank of the river about 600 ft. north of the plant. The pumphouse is mounted on wheels on an inclined track running up the bank so that it may be moved to compensate for fluctuations in the river level. Removing or adding a 10-ft. section of pipe from the 14-in. pipe line will raise or lower the pump about 3½ ft.

During the flood, however, the water rose to



Alabama Sand and Gravel plant, from west

Temporary pump furnishing Alabama Sand and Gravel plant with water from flooded pit

such an unprecedented level that the pumphouse was raised to the end of the inclined track and could go no further. It was then necessary to hoist the pump and motor to the top of the pumphouse, above high water level, where they remained until the flood subsided.

A temporary pump was installed at the edge of the pit 300 ft. west of the plant as soon as the flood subsided below the level of the plant foundations and was used until the regular pump could again be put into operation. This was a Worthington 10-in. centrifugal pump direct driven by a 150-hp. General Electric motor. A small Fairbanks-Morse Typhoon centrifugal pump at the same location pumps water through a pipe line to a wooden tank for the locomotives and draglines. This pump is a permanent installation, housed in a small frame building.

The floods which caused so much damage in southern Alabama last spring did considerable damage to this plant and caused a shut-down of two weeks. The Alabama river rose 57 ft. above its normal level at this point and covered the entire property to a depth of from 2½ to 5 ft. The normal flood stage is about 35 ft. and a stage of 37 ft. is enough to necessitate shutting down the plant. The plant resumed operation on March 29.

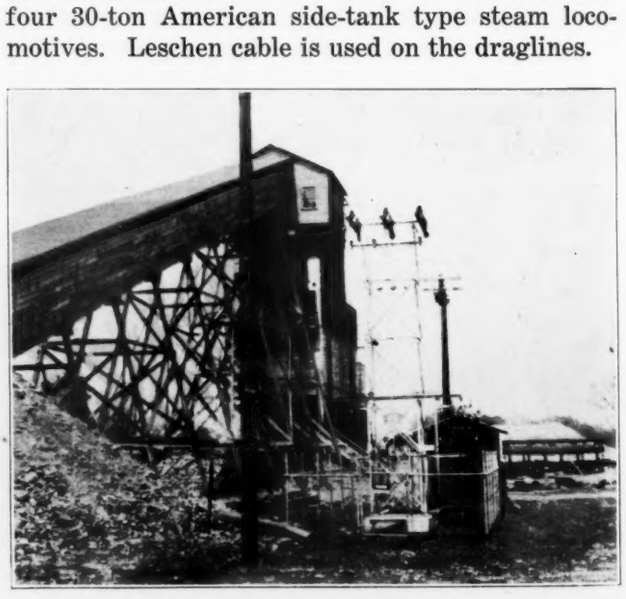
The principal damage caused was the caving in of the banks of the pits, which are approximately 40 ft. deep, destroying from 10 to 15 ft. of good digging. These pits are normally dry. Many hundred feet of the standard gauge track from the pits to the plant were washed out. One of the large draglines was toppled over into the pit by a bank cave-in. This had to be completely taken apart and reassembled when the water subsided sufficiently. The entire force of 40 men and an extra crew of equal size worked night and day for two weeks building track, draining pits, relocating the river pump and loading ballast from stockpiles. The track hopper at the plant was also flooded. The Porter locomotive furnished steam for 30 hours for an ejector pump to drain this hopper. Drainage of the pits was accelerated by cutting a canal between the two pits with one of the draglines and another canal 200 ft. long from one of the pits to the river.

The Roquemore Plant

The Montgomery plant of the Roquemore Gravel Company is the largest in the South. It was designed by Frank M. Welch of the F. M. Welch Engineering Service, and has operated for four years with no important changes in the plant, although additional draglines, locomotives and cars have been purchased from time to time. It has a capacity of about 250 cars per day.

The property, of 1,600 acres, is located about 2½ miles north of the heart of Montgomery on a point of land formed by a sharp bend in the Alabama river which almost surrounds the property. The depth of the deposit, which is about 60 per cent gravel, varies from 40 to 80 ft. and the overburden averages about 3 ft.

The pits are being worked in a circle about the plant, over 100 acres having already been excavated. Three Bucyrus draglines are used, two 4-yd. Class 24 and one 2½-yd. Class 80, all using Page buckets. They load into trains of 12-yd. Western side-dump cars which are hauled to the plant by four 30-ton American side-tank type steam locomotives. Leschen cable is used on the draglines.



Alabama Sand and Gravel plant from southeast. Loaded dump cars in background

The cars are dumped into a concrete track hopper which feeds an enclosed 48-in. to the plant. Dodge conveyor rollers are used. Drive is at the head end by a 125-hp. Clark electric motor through belt and gear.

A jet of water washes the gravel as it is discharged from the conveyor into a chute to the screens. The two main revolving screens are of Greenville make, similar to those used in the Alabama and Flomaton plants, each having two jackets and a washer. They are driven through belt and gear by 50-hp. Clark electric motors.

The oversize goes to a second set of two Greenville screens on the floor below. These are similar to the main screens but smaller. Six sizes of material are produced, the large screens sizing ¼ in. to 2½ in. and ¾ in. to 2½ in. for paving and building gravel, and ¼ in. to 2½ in. to ¾ in. and ¼ in. to 1 in. The small screens produce pea gravel and sand.

Five wooden bins under the screens have a capacity of 100 tons each, sufficient to take care of any short delay in the flow of the material to the plant. Only four of these bins are now in use, one for sand, one for pea gravel, and two for stone. Cars are loaded on four tracks under the bins and are switched by two Baldwin 65-ton steam locomotives. Shipments are made over a track owned jointly with several other companies which serves four railroads through Montgomery.

A smaller plant nearby was built in 1922 but is not now in use. In case of an excessive demand or an emergency, however, it is capable of producing 75 cars of gravel per day. It is of the same general type of design with a track hopper and inclined conveyor, same type of revolving screen and a stationary sand screen.

Two 6-in. centrifugal pumps on the river bank furnish washing water. These were flooded out and were supplemented by a 10-in. Allis-Chalmers pump driven by a 150-hp. Allis-Chalmers motor temporarily located at the pit. A 3-in. Worthington centrifugal pump furnishes water to a wooden tank for the locomotives and draglines. An Industrial Works locomotive crane equipped with a Williams clamshell bucket rehandles material from the stockpiles. Guardene fire extinguishers are used throughout the plant.

As overturned dragline appeared after flood had somewhat receded

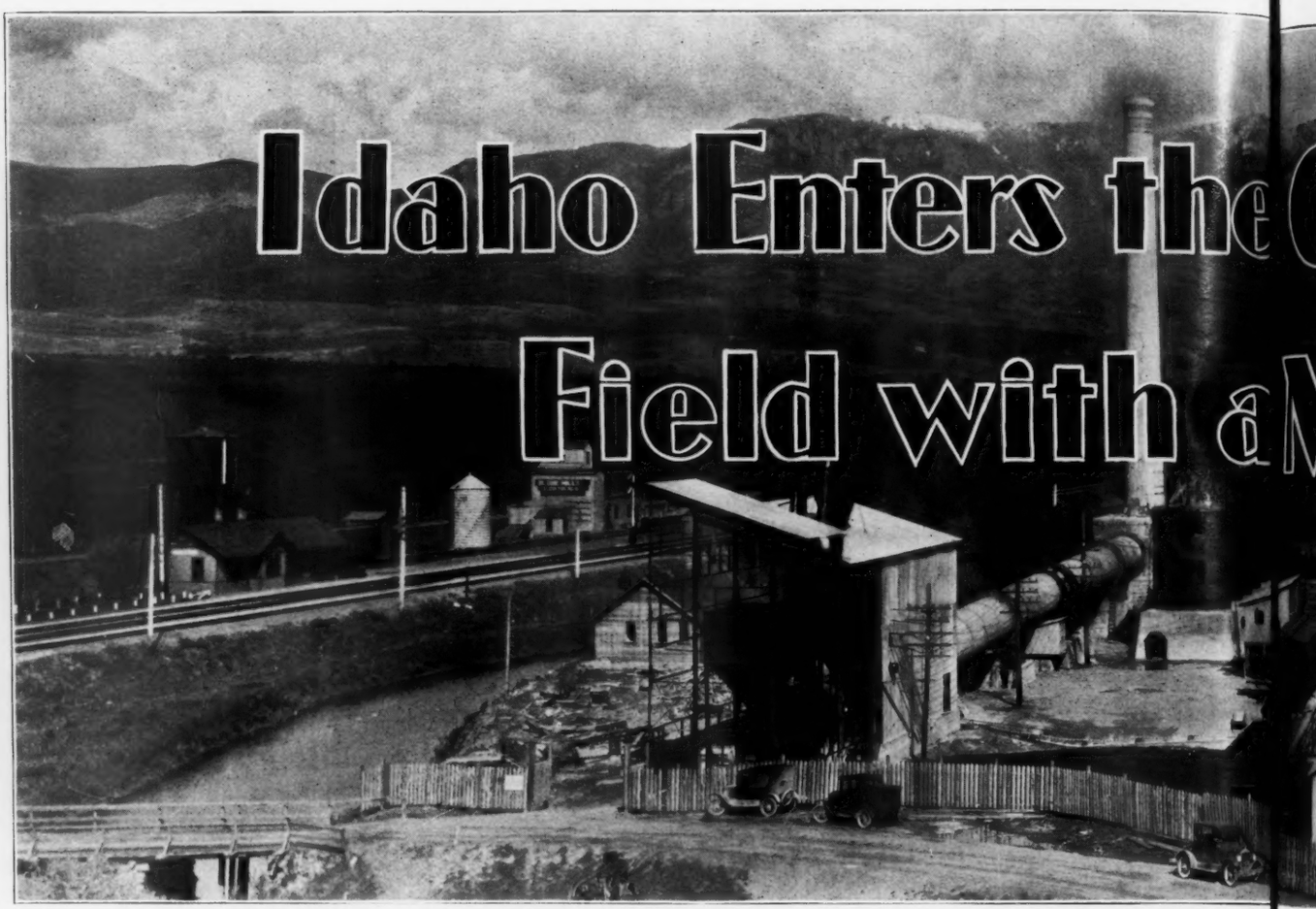
Cut made to drain flooded pits of Alabama Sand and Gravel plant into Alabama River

The flood did comparatively little damage to this plant although the water inundated the entire property and rose to a height of 3 or 4 ft. on the sides of the buildings. Some sections of track were washed out and one of the draglines was on the verge of toppling into the pit when the flood subsided. A drainage channel from the pit to the river allowed the water to drain out rapidly.

The office of the Roquemore Gravel Company is located in the Martin building, Montgomery, Alabama. J. D. Roquemore, who is a member of the board of directors of the National Sand and Gravel Association, is president and general manager; W. A. Bellingrath is vice president; R. M. Hobbie is secretary and treasurer; and J. H. Whigham is sales manager. A. S. Dickson is superintendent of the Roquemore, Montgomery plant.

Cement Rights Obtained

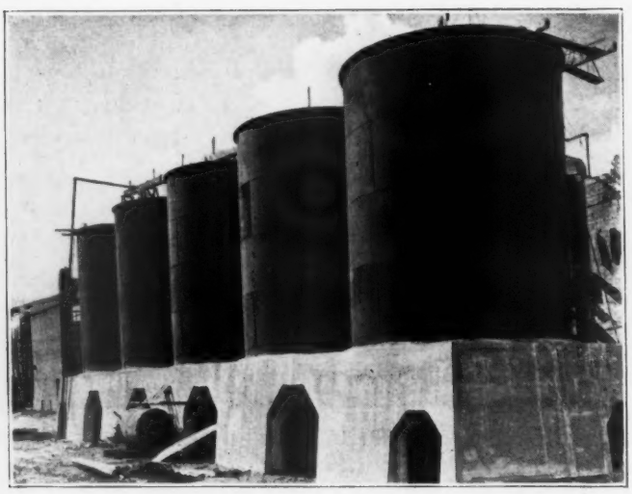
Announcement was made recently that E. G. Riebe, Seattle engineer, has obtained the North American rights of manufacture and sale of a material for a waterproofing and quick drying cement. Mr. Riebe, a graduate of the University of Berlin, returned to Germany last fall and obtained rights for the newly developed German material.



Idaho Enters the Field with a

By GORDON F. SONDRAKER

THE NEW plant of the Idaho Portland Cement Co. at Inkom near Pocatello, Idaho, was placed in operation in June of this year. While the buildings were not quite complete and other minor changes remained to be made, it was decided by the officers of the company to place the plant in operation in order that the product, Eagle Brand cement, might be placed on the market during the summer construction period and that definite dealer connections might be established before the winter, with its consequent slack in trade might set in.



Slurry silos

The company was conceived by a group of business men of Spokane, Washington and Pocatello, Idaho, headed by E. J. Simons, president of the General Machinery Company of Spokane. Erection of the plant was started during the fall of 1928. Situated on the beautiful Port Neuf river, the company enjoys all the natural facilities necessary to a successful cement plant. It was intended originally to establish a quarry on a large ledge of lime-rock near the company's mill, but, as a cut was being made through a hillside preparatory to laying tracks for the narrow-gauge railroad, it was discovered that the hill itself contained an immense quantity of shattered lime-rock and shale so intermixed as to almost form an ideal raw mix. Immediately upon this discovery sufficient exploration work was performed to prove up an immense tonnage of this material in the hill. In fact the tonnage is sufficient to furnish this plant with material for well over two hundred years, if operating at its present capacity. The hill roughly measures 2,200 ft. in length by 400 ft. in height and contains 80 acres. The company owns also a shale deposit covering approximately 80 acres, although, from the present knowledge of the shattered lime deposit, it appears probable that the shale deposit will never be used.

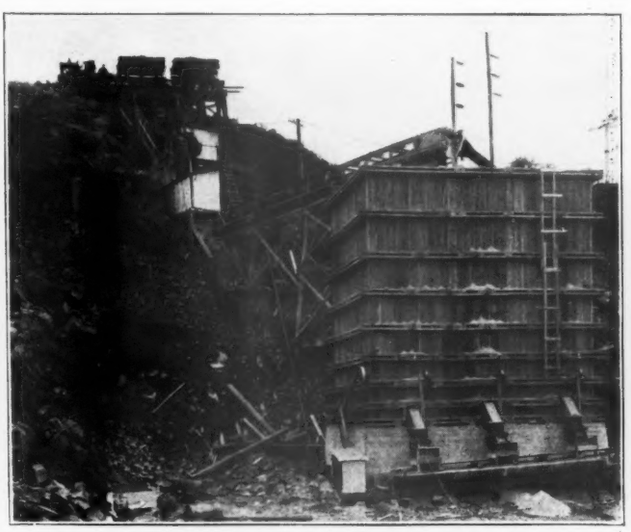
Cement Producing a Modern Plant

One may gather an idea of the nature of the deposit when it is stated that, to date, no powder has been used on the deposit, the material being so small in size that it may all be handled easily by steam shovels. As one may readily perceive from the panorama photograph shown herewith, the deposit is about 100 feet higher than the plant, thus allowing a gravity flow of material through the plant and the consequent elimination of many elevators that are customary in the average cement plant.

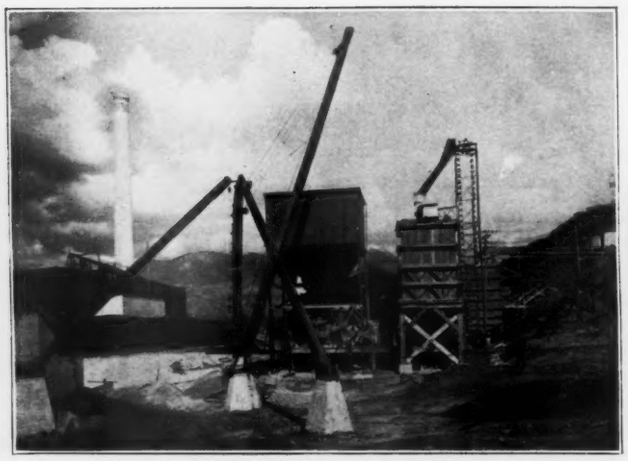
A 7-ton gasoline locomotive, designed especially for this operation by the General Machinery Company of Spokane, Wash., hauls six 5-yard Western side-dump cars over 1,800 feet of narrow-gauge track running from the crushers to the fathest end of the quarry. A Speeder gasoline shovel equipped with a ½-yard dipper and powered by a 45-hp. Hercules gas engine, and a General shovel equipped with a ¾-yard dipper dig the material from the quarry and dump it directly into the dump cars which convey the material over a grizzly manufactured of railroad iron. This grizzly eliminates the material 3 in. and under in size and passes the oversize material to a 12-in. by 24-in. Reliance jaw crusher.

This crusher reduces the oversized material to 3-in. and under and then lets it fall to a vibrating screen manufactured by Universal Vibrating Screen Company. This screen removes the material ¾-in. and under in size and passes it to a General Machinery Company's belt conveyor 24 in. in width and 77 ft. in length. The oversized material falls into a Type B 36-in. by 24-in. Jeffrey hammer-mill and is reduced to ¾-in. and finer. This material then falls to the conveyor belt mentioned above and is conveyed to wooden storage bins having a total capacity of 800 tons of dry material.

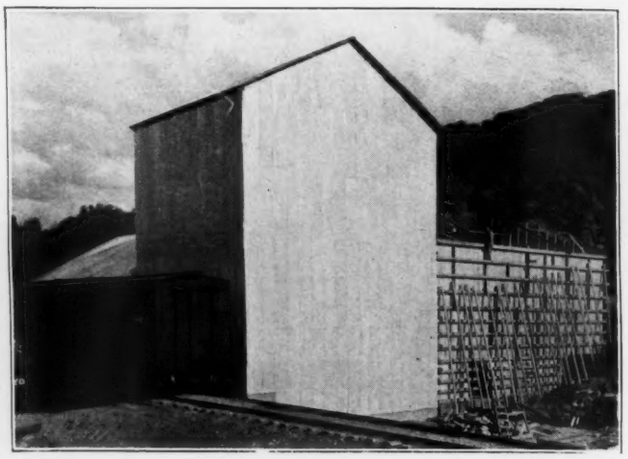
The material is drawn from the storage bins



Crusher and storage for crushed rock



Stiff-leg derrick to handle clinker



Temporary packing house and cement storage bins

onto a General Machinery Company conveyor belt measuring 20 in. in width and 108 ft. in length. The material is drawn from the bins onto this belt conveyor by three variable-speed feeders especially designed for this particular operation by the same company. Due to the variable speed of these feeders, a preliminary mixture of the raw materials is obtained at this point. The belt conveyor conveys the material to a General Machinery Company bucket elevator having 55-ft. centers and using 7-in. by 14-in. buckets. This elevator takes the material from the belt conveyor to wooden storage bins over the raw mill.

Raw Grinding

The raw material ¾-in. and finer is drawn from the mill bin onto an Allis-Chalmers table feeder which, in turn, feeds it into an 8-ft. by 7-ft. by 26-ft. Allis-Chalmers Compeb mill. This mill is driven by a 600-hp. Allis-Chalmers high-torque motor through a flexible coupling. The motor operates at 180 r.p.m. and the mill turns over at the rate of 20 r.p.m. Water to form the slurry is introduced into the mill at the feed end. As the slurry leaves the mill it is taken by a 3-in. Wilfley pump, which is driven by a 40-hp. Howell motor through a flexible coupling, and is pumped to any one of the five steel slurry tanks.

Each of these steel slurry tanks measures 20 ft. in diameter by 25 ft. in height and each has a concrete cone bottom. Slurry is agitated by air through a system designed by the General Machinery Company. Piping is so arranged that any of the five tanks may be used either for mixing, storage, or kiln feed. Slurry is pumped from tank to tank, in correcting, by a 4-in. Krogh pump manufactured by the Krogh Manufacturing Company.

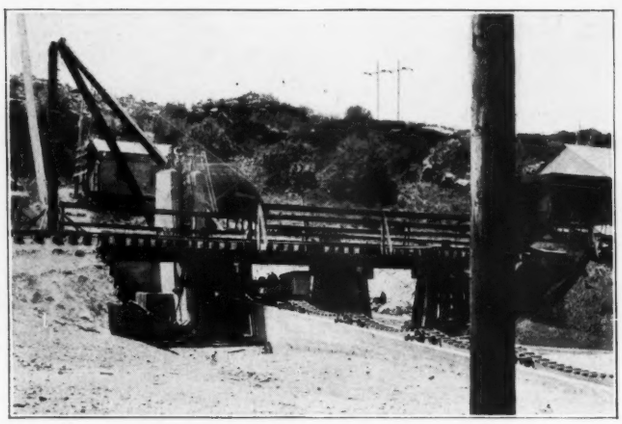
This pump is driven by a 30-hp. Howell motor through a flexible coupling. After a thorough and satisfactory raw mix is obtained, slurry is pumped from the tank then being used as a kiln-feed tank to an Allis-Chalmers ferris-wheel type kiln-feeder by a 3-in. pump manufactured by the Union Iron Works.

Plant crew on July 7, 1929, opening day

Interior, machine shop

Clinker Burning and Coal Handling

The ferris-wheel type feeder supplies the slurry to a water-jacketed feed-pipe which, in turn, introduces the slurry to the kiln. Any slurry overflow from the feeder is returned to the slurry feed tank by a 2-in. Union Iron Works centrifugal pump



Clinker drag conveyor

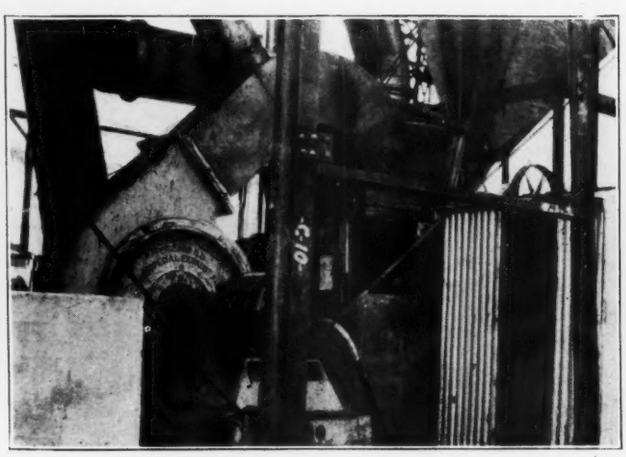
driven by a 5-hp. Howell motor through a belt drive.

A single Allis-Chalmers kiln, measuring 10 ft. in diameter by 200 ft. in length, is in operation. This kiln is supported by four sets of single-roll trunions and is driven by a 75-hp. 6-phase variable-speed Allis-Chalmers motor, through a gear speed reducer. Full speed of the kiln is one and one-

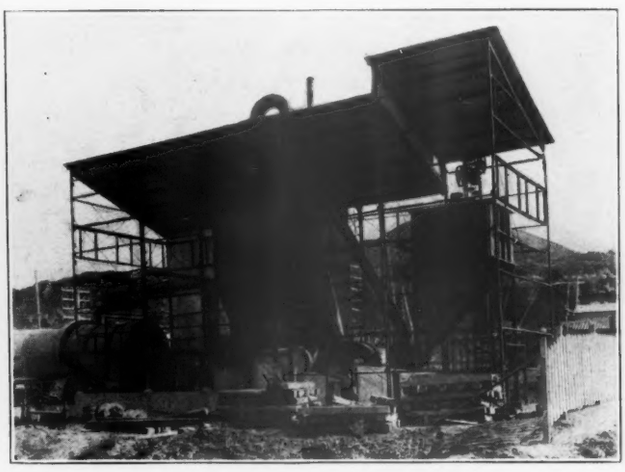
J. B. Maxfield, first vice-president, Idaho Portland Cement Company

quarter minutes per revolution and slow speed is two and one-half minutes per revolution of the kiln.

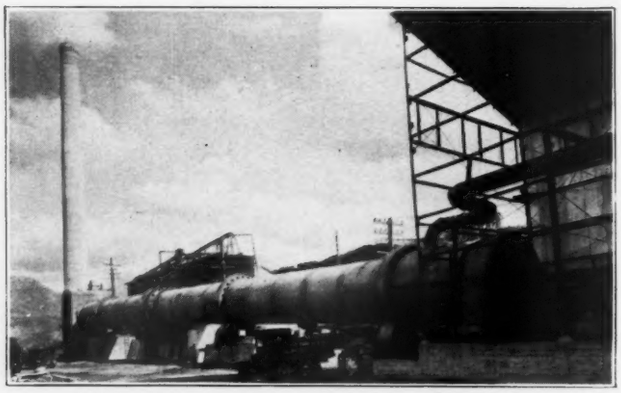
Fuel for the burning of the clinker consists of powdered soft coal obtained from the mines of Utah. This coal is received in gondola cars on elevated tracks over the coal storage. The coal is dumped from the cars into the storage pit. A General Machinery Company drag-line takes the coal from the storage pit to a General Machinery Company elevator having 35-ft. centers and using 7½-in. by 16-in. buckets. This elevates the coal to a 30-ton-capacity steel bin from which it flows by



Coal grinding and drying mill



Coal pulverizing and drying plant



The kiln

gravity to the feeder of a 5-roll low-side Raymond mill. This mill reduces the material so that 80 per cent will pass through a 200-mesh screen. The coal, when properly sized, is drawn from the mill by a Raymond air separator having a 16-in. fan. The ground, dried coal then goes to a 30-ton-capacity steel bin over the kiln. Heat for drying in the Raymond mill is obtained through piping from a hood over the front end of the kiln.

Coal for burning is drawn from the afore-mentioned fuel bin by a double-screw type Allis-Chalmers coal feeder and is blown into the kiln by a 48-in. Sirroco fan manufactured by the American Blower Company. The kiln is operated in three 8-hour shifts.

Clinker Handling and Finish Grinding

The clinker falls from the kiln to a Link-Belt drag chain conveyor 110 ft. in length and is discharged into a Link-Belt bucket elevator having buckets measuring 20 in. by 14 in. by 7 in. Both the chain drag and the elevator are driven by a 25-hp. motor through a Falk speed reducer. This motor as well as all Howell motors in use throughout the plant are manufactured by the Howell Motor Company. The elevator discharges the clinker into the storage pile where it is distributed for cooling by means of a stiff-leg derrick and a clam shell. The derrick is driven by 75-hp. and 25-hp. Westinghouse motors.

The same stiff-leg derrick reclaims the clinker from the clinker storage pile and places it in a 16-ft. square steel bin over the finish mill. Gypsum is added in this bin, according to requirements by the same derrick.

Gasoline shovel in quarry

Clinker is drawn from the mill-feed bin onto an Allis-Chalmers table feeder and is fed into an 8-ft. by 7-ft. by 30-ft. Allis-Chalmers Compeb mill. This mill is driven through a Falk flexible coupling by a 600-hp. Allis-Chalmers high-torque motor operating at 180 r.p.m. The finished cement is discharged into a 5-in. Fuller-Kinyon pump driven, through a Falk flexible coupling, by a 25-hp. Howell motor. The cement is pumped by this Fuller-Kinyon pump to two temporary stock-house bins in the temporary stock house, or rather immediately adjoining it.

The cement is drawn from either of the two bins by a Link-Belt screw conveyor 12-in. in diameter by 6-ft. in length. This conveyor delivers the material to a General Machinery Company bucket elevator having 45-ft. centers and using buckets 7 in. by 14 in. The elevator elevates and dumps the cement into an 18-in. by 12-ft General Machinery Company rotary screen using 10-mesh screen cloth.

Compeb mill handling raw material

This screen removes any tramp material that may have found its way into the cement since leaving the finish mill.

From the screen the cement falls into a steel bin over the packing machine. This bin has a capacity of 160 barrels of cement. From the bin it is drawn into a Bates 3-valve packer and, after packing, is either trucked by hand into freight cars for shipment or loaded onto trucks. The plant is served by the Union Pacific Railway Company's transcontinental lines.

Machine Shops and Laboratory

The machine shop is equipped with an adequate supply of tools and equipment to take care of the needs of the company. A Monarch 20-in. by 12-ft. lathe takes care of the necessary lathe work. A Champion Blower & Forge Company's powered emery wheel; a drill press manufactured by Aurora Tool Works; a milling machine manufactured by Rockford Milling Machine Company; a 14-in. American wood-joiner and a 25-lb. Little Giant power

(*Continued on page* 50)

Action of Water Sweated Out of Concrete On Metals*

DR. F. HUNDESHAGEN

[*While concrete is a most useful structural material, still its use is surrounded with a number of difficulties and disadvantages which must always be taken into consideration. These conditions are due of course to the cement that is contained in the concrete, and inasmuch as the cement manufacturer must be interested in the problems that surround the use of his product as well as in those that appertain to its manufacture, we are giving here a complete translation of an article which was prepared by a prominent engineer and consulting technologist who operates a laboratory in the city of Stuttgart, Germany. This article is concerned with the action of the water that is sweated out of the concrete, or rather of the alkali-caustic ingredients of that water, these substances being derived from the cement, as well as ground water on aluminum, protective coatings and the like. The article is well worth the attention of all cement men.—Trans.*]

THE WATER, which is separated out from fresh concrete construction work, either spontaneously or due to the influence of moderate humid conditions, such as the morning dew, foggy weather or the moist condition of the earth in which the structure is located, contains a large amount of caustic alkali, which, based upon a unit volume of liquid, can be several times that which is contained in solutions that are obtained by the ordinary lixiviation of the cement with large amounts of water. While in the latter instance the alkalinity of the liquid is fixed essentially by the amount of calcium hydroxide washed out of the cement, and hence this alkalinity cannot exceed, or if it does so by a small amount only, the alkalinity which corresponds to a saturated solution of lime water (about 1.30 grams of CaO or 1.72 grams of calcium hydroxide per liter of water), nevertheless alkalies are practically all that are found in the water that is sweated out of the cement. These alkalies are found in the form of their very easily soluble hydroxides, and the proportion of sodium hydroxide to potassium hydroxide varies in accordance with the nature of the cement itself, although as a general rule there is more potassium hydroxide present than sodium hydroxide.

For the most part the alkali content of Portland cement varies between approximately one-half and two and one-half per cent. The origin of the alkali in the cement must be looked for particularly in the feldspathic and micaeous silicates, which are contained in the state of fine subdivision as natural ingredients in the marls and argillaceous materials contained in the raw mixture. These silicates are decomposed in the burning process and the resulting high-basic silicates of the clinker are removed from the mortar due to hydrolytic splitting when it comes into contact with water. A portion of the alkali is volatilized within the cement kiln, and a far greater proportion is removed in this manner in the rotary kiln than in the shaft kiln.

The alkaline ground water and water sweated out of the cement are very low in lime in the first stage of the water action, which is due to the very slight solubility of the limestone in the strong alkali liquors. It is only when the alkalies are removed from the cement, that comes into contact with the water, that further lixviating action of the water causes the removal of the calcium hydroxide, which then dissolves in large amounts. Thus at the outset the concrete structure does not show any signs of the removal of portions of the lime content of the cement, but after a while, particularly when large quantities of lime are removed, small structures are formed which are much like stalactites and stalagmites.

Alkali Containing Water and Aluminum

Various experiments have been made on the action of cement upon aluminum. The use of cement with aluminum in practical work has revealed certain highly unsatisfactory conditions. The changes in aluminum, which have been observed up to the present time to be due to the action of cement, particularly on the walls of aluminum vessels which are surrounded with masonry work, have consisted for the most part of efflorescences of aluminum oxide (accurately the hydrated oxide). It has been recommended that the aluminum should be coated with an insulating coating which consists of jute fabric and tar or other suitable bituminous substances, such as asphaltic paint, and the like. This coating is applied between the aluminum and the concrete or the masonry work. This protects the aluminum against the action of the cement.

However, the fact that such a protective coating will perform its function only when it affords a permanent and completely waterproof film between the metal and the mortar, was well demonstrated

* Zement, 1929, pages 6ff.

by a case in which an aluminum tank, which was surrounded with concrete, was subjected to rather rapid destruction in spite of the fact that an asphaltic paint coating and an insulating coating of jute fabric and tar were provided.

An investigation was made to determine the effect upon the aluminum and the insulating coating, both the metal and the coating being analyzed. The original four millimeter thick metal (consisting of 99.5 per cent pure aluminum) was found to be practically unchanged in the interior. After the insulating coating was removed, the outer side of the metal was deeply corroded and at certain points the metal was entirely eaten through. The surface of the metal was for the most part clean and porous, and was covered at a few places only with a light gray oxidized film. Remains of a thin asphaltic coating were found on the less-strongly attacked portions of the aluminum surface and on the rest of the aluminum was traced quite a regular etched-in or corroded design which corresponded to the structure of the jute fabric. The jute fabric coated with tar appeared to be quite unchanged on the metal side, but on the other side, which was in contact with the concrete, it was covered with a translucent, hard, brittle film of aluminum hydroxide, varying in color from green to yellow to grayish white, of approximately three to five millimeters thickness, in the form of the texture of the fabric which was intermingled with the coating so that the whole film stood out in relief on the tar. The aluminum hydroxide was present partly in the colloidal amorphous condition and partly in the form of the microcrystalline hydragillite. The thickness of this layer was greatest at those points where the corrosion had progressed so deeply that the metal was pitted. The corroded surface of the aluminum, the jute fabric and the aluminum hydroxide crust were impregnated with a strongly caustic-alkaline sweat, which contained calcium hydroxide mixed with a little sodium hydroxide and appreciable quantities of aluminates, but no lime (outside of traces in the insoluble form of the carbonate). A portion of the alkalies was nevertheless present in the form of carbonate compounds in spite of the subsequent action of carbon dioxide containing air upon the alkalies.

It is possible to recover 0.2 gram of soluble alkalies from every hundred centimeters of the sheet metal and the insulating layer which is covered with a film of aluminum hydroxide. This is done by merely washing the metal with water.

There can surely be no doubt that the strong decomposition of the aluminum is due to the action of caustic alkalies, and that the latter can come only from the cement, which is probably high in alkalies. The alkaline, almost lime-free water penetrates through openings in the protective layer and reaches the aluminum and dissolves the metal with the liberation of hydrogen gas. Aluminates are accordingly formed and the solution of the aluminates is driven by the pressure of the hydrogen gas through the meshes of the jute fabric to the outside of the protective layer. Under certain conditions a state of super-saturation is attained and the aluminum is precipitated in the form of insoluble hydroxide, while the alkali, which acts in a certain sense as a catalytic agent, is again returned to re-begin its action upon the aluminum metal and to complete its dissolving and corrosive action.

An important point in the attack of caustic alkalies upon aluminum is the evolution of hydrogen gas, and there are cases where the aluminum tank rests upon a foundation of concrete and where the bottom of the tank is actually found to be lifted up, bellied out. This can have no other explanation except that the pressure of the evolved hydrogen gas forced the metal out of shape.

These examples and others which have been reported lead to the conclusion that it is better to avoid using cement and mortar around aluminum apparatus, rather than to try to prevent the alkalies from reaching the aluminum.

It is also pointed out that other metals, such as lead and zinc, whose oxides form water soluble compounds with alkali, are similarly attacked by alkalies.

Fresh Concrete and Protective Coatings Against Water

It is well-known that fresh concrete has a destructive action upon paints, particularly those that contain fatty oils, such as linseed oil and the like, rosin, waxes and the like. Here again the assumption must be made that the caustic alkali in the cement is responsible for the saponification of these materials. These alkalies are also able to produce changes in pigments which are sensitive to alkalies and which are contained in the paints.

Certain experiments on the action of water sweated out of the cement as well as ground water from comparatively fresh concrete upon varnish-like paint films are reported here. In order to obtain a direct conclusion on the action of alkalies upon the paint films and in order to observe the progress of this reaction, the experiments were carried out under conditions which deviate from those existing in practical work. The water pressure is not allowed to act upon the paint film so that it is pressed against the concrete, but just the other way around, so that the water, after passing through a thick layer of concrete, comes into contact with the back of the paint film.

Hence a number of cubes of concrete were made with cement in the mixture of 1 to 6, these cubes

having ten centimeter sides. In order to afford a surface which is smooth and which allows water to penetrate it uniformly throughout, the outer and bottom surfaces of the cubes were provided with a smooth coating of five millimeters thickness.

Two paints were used in the tests. One is designated as A and gives a more flexible film than the other designated as B whose film is harder. After the smooth surface which was applied to the cubes has been properly dried, half of the cubes were coated with two coats of paint A and half with the same number of coats of paint B. These coats were applied in every case to the external surfaces of the cubes as well as the bottom and the outer edges. After drying the films were smooth and lustrous, apparently entirely impervious and faultless, adhering well to the concrete surface.

After five days, the cubes were suitably placed within a shallow vessel which contained one liter of water when filled to the rim. The cubes were covered with wooden boards and allowed to remain in the water. The water which was lost from the vessel due to penetration into the concrete and which also partially evaporated was replaced by new water from time to time during the two months that the test lasted. The following observations were then made.

First with respect to the cubes coated with paint A. After twenty-four hours, the water level was lowered so that approximately 150 to 200 cubic centimeters less water were present in the vessel. This water was absorbed by the concrete. On the majority of the paint films on the cubes a net-like relief of light lines was formed, the meshes being filled with smaller and larger blisters arranged like the beads in a string of pearls, these blisters being approximately one to five millimeters in diameter. The meshes of the net-work had a diameter of approximately 1.5 to 4.0 centimeters.

The contents of these blisters were found to consist not of water but of air, which was under a definite pressure.

After a second twenty-four hours, the size of the blisters was increased and they were swelled up considerably and were then found to contain liquid as well as air. The size of the blisters continued to increase during the following days and weeks. A few grew to form small overhanging sacs, and others, whose volume amounted to one cubic centimeter and more, finally burst due to the pressure of the liquid. When the liquid was examined, it was found to contain caustic alkali, the yellow having a yellowish, opalescent turbidity. On acidification a resinous precipitate was obtained.

In one case no changes were noted after the first day and no trace of net-work of lines or blisters was seen. It was only after several weeks that these first developed. The water in the vessel was not renewed for months long, in contradistinction to the other tests. The behavior of this sample must be assigned to the greater imperviousness of the paint film.

Second, the tests made with paint B. The behavior was quite different from the first case, although the conditions of the test were maintained constant in both sets of experiments. In this case as well the concrete absorbed a large amount of water, from 80 to 100 cubic centimeters, but the lustrous coating on the cubes remained completely unchanged at the beginning. Several weeks elapsed before signs of the formation of the aforementioned net-work of lines and the blisters within the meshes were seen. The size of the blisters varied from one to two centimeters in diameter.

On the other hand, the paint film on one of the cubes was completely intact after weeks and months had elapsed. It was in this case as well that no new water was added to the vessel during the course of the experiment.

The flat blisters which were formed in the case of cubes painted with paint B, which it will be remembered was a paint giving a harder film than paint A, were also found to be filled with air and a caustic liquid. Nevertheless, the amount of liquid that was recovered from these blisters was very small. Even though in both instances the quantity of liquid obtained was small from the standpoint of the amount required for a careful chemical examination, nevertheless, such an analysis was made with the following results.

Composition of the Alkaline Liquids Obtained from Blisters on the Films of Paint on the Cubes A and B, Figured as Grams per Liter

	Paint A	Paint B
Potassium (principally) and sodium hydroxides	17.0 grams	40.0 grams
Calcium hydroxide ...	about 1.0 gram	scarcely a trace
Magnesium hydroxide.	.....	.....
Saponifiable matter...	clear trace	.....
Sulphates and chlorides	trace	trace

Two points must be called attention to, namely the very definite trace of saponifiable matter contained in the liquid from A and the somewhat larger amount of lime (but this is always very small indeed) in the caustic liquor. The far greater proportion of alkalies in the liquids obtained from B is explained by the fact that the blisters took longer to form and the almost complete lack of lime which is due to the reduced lime dissolving properties of the stronger alkali liquor.

A small area of permeability developed very soon at the bottom in each of the cubes painted with paints A and B. Through this area water penetrated into the interior of the cube as long as the vessel was kept full, and then after some time, water fell in drops from the cubes. This water

was collected and measured as well as chemically analyzed. Within three weeks the amount of water collected amounted to about three liters in the case of the A cubes and about 750 cubic centimeters in the case of the B cubes. As soon as this water was allowed to come into contact with air, a portion of the lime dissolved in it was precipitated in the form of a white deposit of calcium carbonate (in microscopic rhombohedrons) the hydroxide of the metal being present in the water itself. It was also noticed that a whitish deposit formed around the places where the water emerged from the concrete.

The water obtained was examined chemically and the following figures are given based on one liter of water. The lime that was contained in the water in the form of calcium hydroxide and then converted into calcium carbonate on exposure to air, is given in the following tabulation, converted back into the hydroxide form.

Composition of the Alkaline Water Derived from the Cubes of the Series A and Figured on the Basis of Grams per Liter

	Cube A	Cube B
Water obtained in three weeks	about 3,000 cub. cen.	750 cu. cen.
Calcium hydroxide.	0.040 gram	0.098 gram
Potassium hydroxide	0.070 gram	0.632 gram
Sodium hydroxide..	0.030 gram	0.232 gram
Magnesia	trace	hardly a trace
Silica and alumina..	trace	trace
Sulphates and chlorides	trace	trace
Organic matter	trace	hardly a trace

It is seen that there is a certain relation between the amount of water that is collected within a certain definite time unit and the composition of the liquor thus obtained. Thus, the slower the ooze of water from the cubes, the more concentrated the water obtained, that is the more saturated is it with the caustic ingredients of the cement. There are of course other factors that play an important role in this connection besides the time of contact between the water and the cement. These are the manner in which the water passes through the cement, as well as the pressure of the water and the temperature. These two latter factors are, however, excluded here, inasmuch as the experiments were carried out under the same conditions in both instances.

The conclusions that can be drawn from these experiments are very important and instructive. In the first place, the formation of blisters on the paint film covering a block of concrete is due first to air, which is forced out of the cement, under the action of the capillary pressure of the water penetrating into the concrete. Then under the effect of hydrostatic and osmotic pressure the liquid squeezes the water, which is contained in the concrete and which is loaded with a greater or lesser quantity of the water-soluble ingredient of the cement, into the blisters and expands them. The substances which are dissolved by this water out of the cement are for the most part potassium hydroxide and sodium hydroxide, while the proportion of calcium hydroxide is considerably less, due to its lesser solubility in water. Magnesium hydroxide, which is practically insoluble, is not found in the water. This condition applies not only to the water that is actually sweated out of the cement but also to the ground water which enters the concrete structure through various cracks and the like and which also becomes laden with various ingredients of the cement. It is therefore not surprising that the various coating compositions which are used on cement and concrete structures and which contain saponifiable ingredients are rather quickly destroyed by these waters, which they are intended to prevent from entering the concrete.

Chile's Road-Building Program

Chile's road-building program, which was first entered into seriously at the commencement of 1928, was continued with increasing interest throughout the first quarter of this year, as given by Don B. Berry in *Commerce Reports*. In January, the Chilean Congress enacted a law authorizing the president of the Republic to contract loans up to 90,000,000 pesos for highway development this year. In a statement carried in the press during the quarter, it was announced by the minister of Fomento that, during 1928, Chile spent 34,957,244 pesos on highway development, of which approximately 12,000,000 pesos was spent for the construction of new roads. During the year, according to the minister, his department awarded road contracts totaling 43,500,000 pesos.

Previous to the enactment of the law of January providing this fund, the receipts especially destined for highway construction were very inadequate for any extensive plan of improvement.

Slight Increase Shown in Canadian Graphite Imports and Exports

Imports of graphite and graphite products into the Dominion of Canada during the fiscal year ended March 31, 1929 had a valuation of $137,443 as compared with $123,121. Of this total the United States shipped $87,803 as against $71,238 in the previous year.

Exports of graphite were valued at $45,685 while in the previous year the value amounted to $101,288. The amount exported during the period under review totalled 19,100 hundredweight while in 1928, 36,525 hundredweight were shipped from the country.

Charles Warner Company Consolidates Several Companies Near Norristown, Pa.

McCoy Lime Plant Employs Numerous Economic Practices

By F. A. WESTBROOK

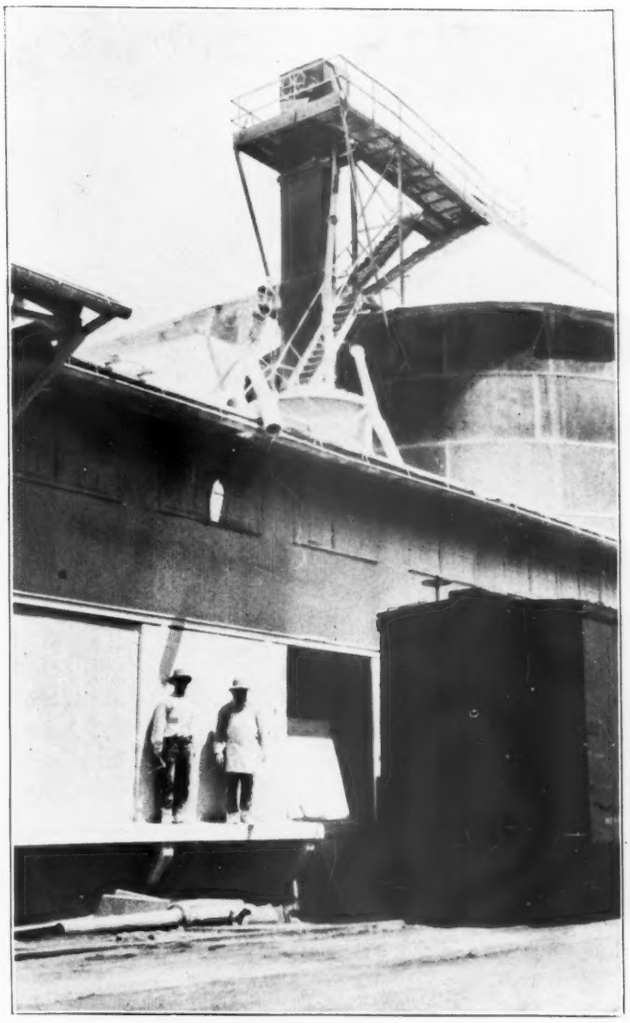
THE McCOY lime plant of the Charles Warner Company of Philadelphia is located at Swedeland, Pa., about three miles outside of Norristown. Caleb S. Wilson is now superintendent emeritus after having been active for nearly thirty years, and John Kelley is the present operating head. An interesting feature of the plant is that its market is within a radius of 30 or 40 miles.

The Warner Company has recently acquired the adjoining property of the Marion Lime Company, and the old Rambo Lime & Stone Company's quarries and kilns. The seven kilns of these two properties have been shut down and the whole merged into one large operation using the McCoy equipment.

Quarrying is being done on two levels. The lower level, which was started recently, is 50 ft. lower than the old level, and it will prolong the life of the quarry for at least 40 years. Blasting is done by the toe-hole process, with 40-per cent Atlass or Hercules gelatine dynamite, four or five times a year. Stone for the kilns is hauled, in Koppel side-dump cars, to the tops of the kilns from the bottom of the quarry over an incline 350 ft. long, with a rise of 150 ft., by means of a Flory electric hoist. In the quarry the dump cars are moved between the working faces to the foot of the incline by Plymouth 5-ton gasoline dinky locomotives.

Warner Company uses at this plant about 90 side-dump quarry cars in which stone for the kilns is stored. By this plan there is always a surplus of raw material loaded ready or immediate use, and rehandling is avoided. This is a policy of Mr. Wilson which was made effective by the purchase of many cars with the several properties.

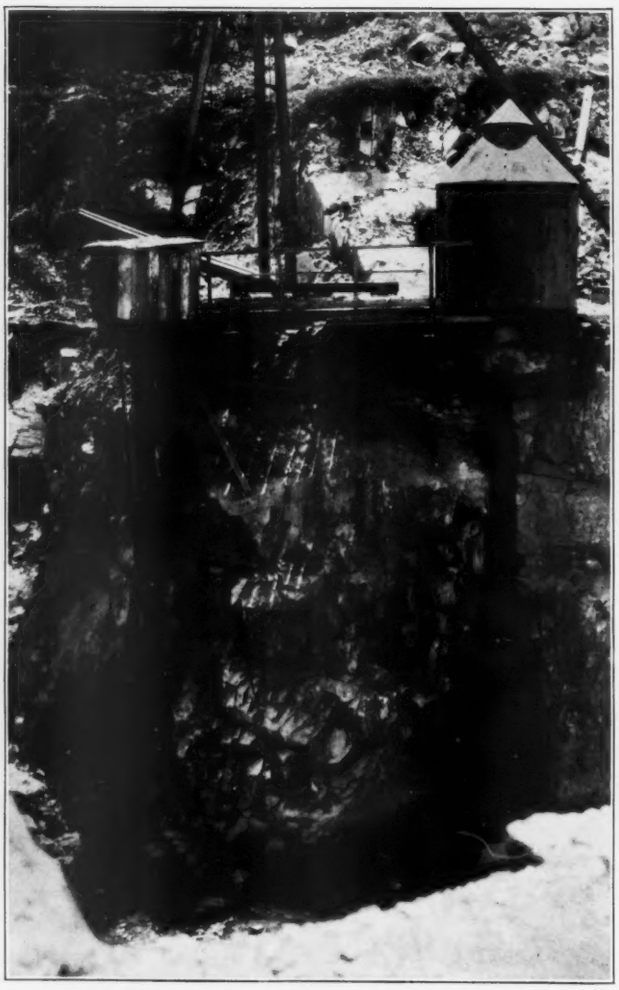
Kilns and hoist house



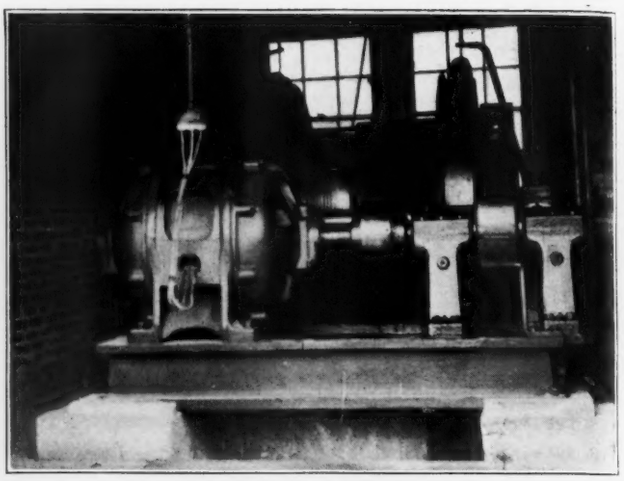
Shipping platform for hydrated lime

Great savings, which more than pay the annual charges on the extra cars, are realized by the reduction in the handling of stone which the cars make possible.

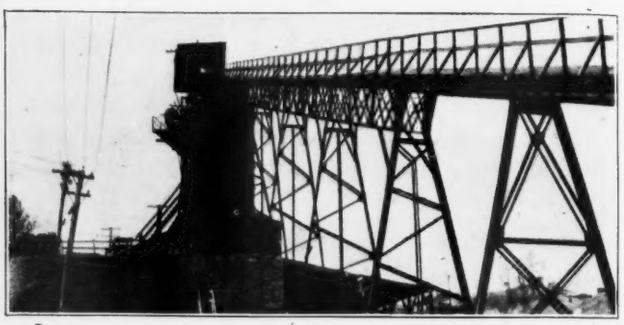
Another unusual and interesting economy is practised in pumping the quarry at its extensive upper level. As it happens, the Rainy Wood, Coal and Coke Company erected a plant close to the McCoy plant and needed a good supply of water from this quarry. The coke company keeps the quarry pumped at its own expense, using two 1,600-g.p.m. Allis-Chalmers centrifugal pumps. This saves the McCoy plant this pumping cost and, for itself, the cost of building a reservoir or of drilling wells with a much longer pipe-line, at the same



Vertical pumps draining new low level



Hoist for elevating cars to top of kiln



Steel trestle to top of kilns

Gasoline dinky hauling side-dump cars on floor of quarry

Office and truck scale

Hydrating plant

time assuring a continuous and sufficient supply of water.

The lower level, on the other hand, being a new development and accumulating water not needed by the coke company, must be pumped by the Warner Company. It was found economical to set two vertical-shaft American Deep Well Pump Company's pumps at the old level of the quarry. The pumps work in 16-in. well drill-holes which serve as sumps.

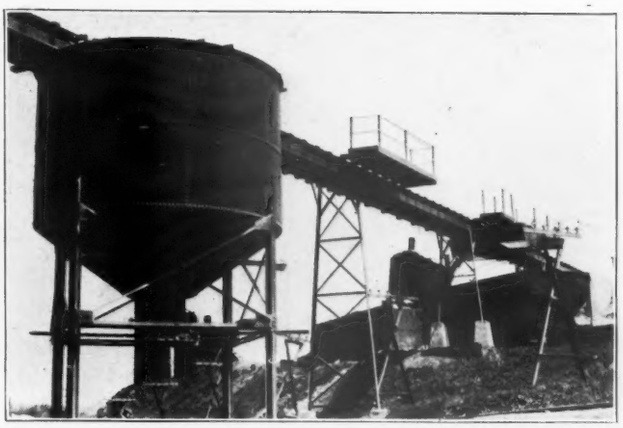
The two double kilns were made locally from designs furnished by the company and employ the Eldred process, using Sturtevant blowers. They are 16 ft. in outer diameter, with an inside diameter of 10 ft. 6 in by 6 ft. in the firing zone and are 50 ft. high above the firing zone. They are double-fired, a small amount of wood being used in burning, to hold up the lime until it is fully burned and to increase the efficiency of the kilns for the heavy operation to which they are subjected. Their production is 1,000 bushels and better per day, with an efficiency of 5 lb. of lime per pound of fuel.

Old part of quarry. Note locomotive, in foreground, about to haul a car

The coolers under the kilns are 10 ft. by 6 ft. by 6 ft. and have a capacity of three draws each, so that the lime comes out fairly cool. Dump cars made from the company's own designs and of 5,-000-lb. capacity are run under the coolers for loading. The tracks from the kilns to the home-made shaking screen near the hydrating plant are almost level and the cars are hauled over it by means of a Flory hoist and 3/8-in. plough-steel wire rope.

At the shaking screen, the lump lime is carried by a Link-Belt belt conveyor to a Link-Belt box-car loader at the railroad siding for bulk shipment. Lump lime is shipped by cars and trucks.

The fine lime which drops through the screen falls onto a 42-in. Link-Belt pan conveyor which delivers it to an elevator discharging in the 40-ton steel storage bin. From this, the lime passes by gravity to a Jeffrey pulverizer. After pulverization the lime may be disposed of in either of two ways. It can be elevated directly to the 2,000-ton storage bin or it can be delivered by another



Trestle over railroad tracks and roadway for loading spalls into trucks and freight cars

elevator and a screw conveyor to the Kreitzer hydrator.

From the storage tank the lime may be delivered to the four-tube Bates valve-bag packer or it may be delivered to the hydrator by a Link-Belt screw conveyor. In this way, both the hydrator and the burned-lime bagger may be supplied from the ground-lime storage, or the hydrator may be supplied direct from the pulverizer, thus securing a maximum of flexibility.

The hydrated lime is elevated to an Abbe tube-mill for final pulverizing and is then again elevated to an 8-ton steel storage tank that feeds a two-tube Bates located on the shipping platform.

There is a separate incline from the quarry to the surface for spalls, used as slag stone and in roadwork. Koppel side-dump cars are operated over this incline by a Flory electrical hoist. The arrangement for handling the spalls is ingenious. The cars are hauled onto a steel trestle extending across two railroad spurs and a wagon-road. The quarry cars may be dumped into chutes discharging in gondola cars below, or into a steel storage tank from which trucks may be loaded. The steel work was made at Bridgeport Iron Works from company designs. When the steel tank is full and there are no freight cars to be loaded, the quarry cars are dumped at one end of the trestle and the stone is made into storage piles by a 1/3-cu. yd. Erie steam shovel. Subsequently, when the stone is to be shipped, it is reloaded into the quarry cars by the Erie shovel and dumped from the trestle.

Conveyor for lump lime to trucks

Some Peculiar Properties of Sands

By J. E. WORSDALE

SAND is a very peculiar material, particularly in its physical behavior, since it is intermediate between a solid and a liquid. Solids are very well understood, and to handle and work them needs only the application of ordinary engineering principles; and, similarly, with liquids, ordinary knowledge of hydraulics enables one to deal with them effectively, and their physical behavior is well understood. Sand, however, is intermediate between these two physical states, and frequently acts in a manner difficult to understand.

If any ordinary material is compressed in one direction, its volume is reduced—as for example, when a sponge soaked with water is pressed between the palms of the hands, the volume is reduced and water is expelled. This is not the case, however, with sand. If a bag full of sand is pressed between the hands, the volume of the sand is *increased* instead of decreased. This statement may seem rather startling, and indeed it is not generally known, but the following experiment will demonstrate its truth.

If a thin india-rubber bag is filled with sand and water so that most of the volume is occupied by the sand, but excess of water is present so that it stands above the top of the sand and extends into a manometer tube securely placed in the opening, then if the bag is pressed laterally between the hands, a peculiar action occurs. The water is not expelled as would be the case if the bag contained water only, or anything of the nature of a sponge, but is sucked into the bag. The volume occupied by the sand has been increased and, since the individual particles have naturally not been affected, it follows that the space between the particles has been increased. In other words lateral pressure has increased the void content of the sand. Some remarkable experiments can be carried out illustrating the action of change of void content with pressure, and the following is rather spectacular.

If in the above experiments the mouth of the bag is tied tightly so that no water or air can be sucked in, the bag exhibits some peculiar properties. When standing on the table, the elasticity of the envelope gives it a rounded shape, with the sand settled to the bottom and the excess of water appearing above it. The bag may be pressed from above and its shape altered in quite the expected manner; but if it is pressed laterally between the palms of the hands, it submits at first without resistance, then all at once the whole becomes rigid. Turning it on its side, it will bear the weight of a man without any change in shape, yet on rolling it back to its original position, the bag becomes soft and rounded in shape as before. In Fig. 1 a rubber bag consisting of a football bladder filled with sand and water is being pressed by the foot and the rounded shape of the cavity so formed indicates the usual property of elastic envelopes when deformed. In Fig. 2 the bag has been pressed laterally between the hands and then turned on its side, and it now supports a man's weight without any deformation.

Fig. 1

Fig. 2

Again, if the bag is pressed on a table with a large flat weight, the envelope flattens out to a disc shape, but on removing the weight the elasticity of the bag causes a lateral pressure and the mass becomes rigid. If it is now turned on its edge it remains rigid, but on pressing laterally all strength vanishes, and we have again a rounded bag of loose sand and water.

The discoverer of the effect of pressure on the void content of sand was the late Professor Osborne Reynolds, of Manchester, England, who gave it the name "dilatancy" and, although he published his results more than forty years ago, his work is not widely known. The experiment with the bag was outlined by him in his original paper on the subject and some of his observations on evidences of dilatancy have been utilized later in this paper.

The present writer, in an address before a British Engineering Society a short time ago, in explaining the theory underlying dilatancy, used a number of tennis balls to demonstrate void changes and the photographs reproduced in Figs. 3 to 8 were taken from the actual apparatus. Let us assume that the particles of sand are uniform spheres, illustrated by the tennis balls.

If a pile of these spheres is built up, it will be found that there are three methods of symmetrical piling which produce different void contents and any other method of piling will give one of the results of these three methods. The most open packing is to place the spheres for the base in a rectangular grid, the second and subsequent layers containing the spheres vertically above these. Figs. 3 and 4 which give the view of this packing from

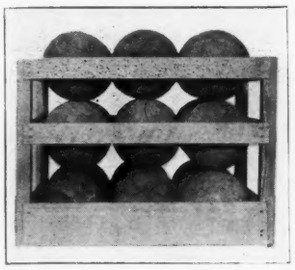


Fig. 3

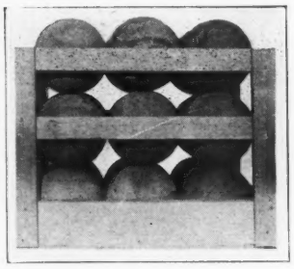


Fig. 4

two directions at right angles indicate the open nature and large voids.

A packing which gives less void content is produced by making the lowest layer exactly as above and placing spheres of the second layer in lines vertically above those in the lower layer but in positions formed by the hollows between pairs of spheres. This packing is illustrated by Figs. 5 and 6, which show an open packing in one direction and a close packing in that at right angles.

The closest packing is to place the spheres in the hollows formed between four spheres in the lower layer. Figs 7 and 8 indicate that close packing occurs when viewed from either direction.

For convenience, we will call the three methods by numbers in the order of increasing voids:

No. 1—Closest packing...26.0 per cent voids
No. 2—Intermediate .....39.5 per cent voids
No. 3—Loosest .....47.6 per cent voids

It should be noted at this point that when there is no lateral support to the piles of spheres, No. 1 is stable, whilst both 2 and 3 are meta-stable. That is to say, a slight lateral pressure will not disturb No. 1 packing, but it will throw Nos. 2 and 3 out of balance. In No. 3 the support of each sphere is a point support directly under the centre of gravity of the sphere, and therefore a slight shift of the centre of gravity causes loss of equilibrium. In No. 2 case there is two-point support, but the spheres are obviously meta-stable in the direction at right angles to the line of these points. In No. 1 case, each sphere is supported by those below it, and there is multiple-point suspension.

If now we imagine three piles of spheres in the three systems of piling, and pressure is applied vertically downwards, in systems 2 and 3, the spheres will roll outwards and downwards because of the unstable equilibrium. But in Case 1 with the closest packing, the vertical pressure is transmitted to a lateral internal pressure owing to each sphere resting on four lower ones, and the pile is disturbed by a bursting action.

This action can be illustrated by the examination of the manner in which dry sand piles up when discharged from a funnel. The pile of sand is increased by a heaping up of the particles at the top until the pressure bursts the pile and the particles then run down the side and the process is repeated. From this we can draw but one conclusion, that, when sand is run into a pile from one point, the first packing is Case 1, and that this breaks down into one of the other systems, and then the fresh sand makes up again as in Case 1 and breaks down again, and so on.

The above is the explanation of dilatancy as applied to spherical particles of uniform diameter and, by analogy, the case of ordinary sand particles can be considered to give similar results.

Returning now to some more evidences of dilatancy, everyone who walks on a sandy beach must have been struck at different times with the varying firmness and softness of the sand, quite apart from when it is loose and dry. At one time it will be so firm and hard that you may walk with high heels without leaving a footprint, whilst at others although the sand is not dry, one sinks in so as to make walking painful. Careful observation shows that the sand is firm as the tide falls, and becomes soft again after it has been left dry for some hours. The reason for this difference is exactly the same as that of the closed bags with water and air in the interstices of the sand. The tide leaves the sand, although apparently dry on the surface, with all its interstices perfectly full of water, which is kept up to the surface of the sand by capillary attraction: at the same time the water is percolating through the sand from the sands above where the capillary action is not sufficient to hold the water. When the foot falls on this water-saturated sand, it tends to change its shape, but it cannot do this without enlarging the interstices—without drawing in more water. This is a work of time, so that the foot is gone again before the sand has yielded. When standing still, it will be noticed that the feet sink more or less and that, on moving, the sand becomes wet all round the space lately stood upon, which is the excess of water drawn in, now set free by the sand regaining its densest form.

One phenomenon attending walking on firm sand is very striking: as the foot falls, the sand all around appears to shoot white or dry momentarily, soon becoming dark again. This is the suction into the enlarging interstices below the foot, which for the moment depresses the capillary surface of the water below that of the sand.

After the tide has left the sand for a sufficient

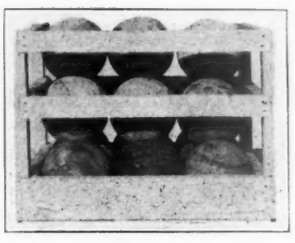


Fig. 5

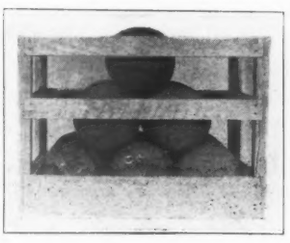


Fig. 6

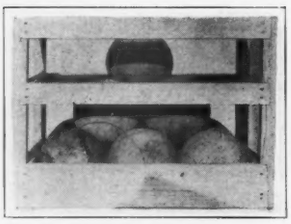


Fig. 7

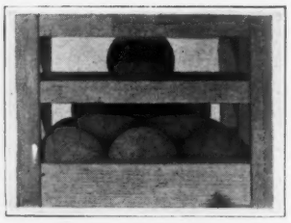


Fig. 8

time, the greater part of the water has run out of the interstices, leaving them full of air which, by expanding, allows the interstices to enlarge, and the foot to sink in far enough to make walking unpleasant. If we walk on sand under water, it is always more or less soft, for the interstices can enlarge, drawing in water from above.

The firmness of the sand is thus seen to be due to the interstices being full of water and to the capillary action or surface tension of the water at the surface of the sand. This capillary action will hold the water up in the sand for some inches or feet, according to the firmness of the sand, as can be shown by a somewhat striking experiment. If sand running in a stream from a small hole in the bottom of a vessel (as in an hour-glass) is allowed to fall into a vessel containing a slight depth of water, the sand at first forms an island, which rises above the water. The sand which then falls on the top of this island is dry as it falls, but capillary action draws up the water, which fills the interstices and gives the sand coherence. The island grows vertically, very fast, and assumes the form of a column sometimes with branches like a tree or a fern, some inches or even a foot high. The strength of these consists in the surface tension of the water preventing air from being drawn in to enlarge the interstices which, therefore, cannot change shape. This is just another evidence of dilatancy, which should appeal to the man versed in the use of moulding sand.

Florida's Coquina Rock Is Quarried For Architectural Purposes

Among Florida's numerous and fascinating attractions are the beds of coquina rock, solid masses of broken shells of sea animals, mixed with sand and cemented together and found only where the ocean bed has once been. It is used for building purposes.

Natural and picturesque is the beauty resulting from the coquina architecture blending into a background of tropic shrubbery and a clear blue sky. This yellowish rock substance is not only attractive but is strong, turning a bold front to the roughest gales and keeping its natural buff shade, regardless of the beaming sun.

Many of Florida's most attractive homes are built of Coquina or of Coquina stucco. Some are massive, having spacious lawns and gardens dotted with benches, bird baths, etc., made from a mixture of concrete and coquina. Others are cozy little Spanish type bungalows, with windows and cool porches protected by gaily striped awnings.

Idaho's New Cement Plant

(*Continued from page* 40)

hammer manufactured by the Star Foundry Company comprise the balance of the equipment. Three air compressors are in operation. One of these, a 12-in. by 12¼-in. Ingersoll-Rand single-stage air compressor driven by a 50-hp. Westinghouse motor through a belt transmission, is housed in the machine shop. This compressor furnishes the air necessary for slurry agitation. An 8-in. by 9-in. Sullivan single-stage compressor furnishes air for the Fuller-Kinyon pumping system. A 30-hp. Howell motor drives this compressor through a belt. An 8-in. by 9-in. Chicago Pneumatic compressor driven by a 50-hp. motor through belt transmission is used as an auxiliary in time of need. All of the compressors are connected by a single pipe-line so that each may be used for any desired purpose.

A completely equipped laboratory, under the direction of F. H. Beyer, chief chemist, insures the quality of cement before it leaves the mill. The laboratory is equipped with a small crusher, and a pebble mill, manufactured by the General Machinery Company, a Tinius Olsen tensile-strength machine, and other equipment necessary for successful operation.

The officers and directors of the Idaho Portland Cement Company are: E. J. Simons, president, of Spokane, Wash.; J. B. Maxfield, first vice-president and general manager, of Pocatello, Idaho; J. H. Neill, second vice-president, of Irvine, Wash.; J. Tom O'Brien, treasurer, of Spokane, Wash.; and A. J. Lindsay, secretary, of Spokane, Wash. B. B. Pierce is construction engineer and superintendent.

As may be seen from the accompanying photographs, the plant and buildings are incomplete, but a construction crew of men is maintained to rush the plant through to completion as rapidly as possible. Plans call for the erection of concrete silos for cement storage with a capacity of 100,000 barrels of finished cement. Bids for this work have been taken by the Idaho Portland Cement Company and it is expected that work on the silos will be started in the near future.

Production, as has been noted before, started on June 6, but the formal opening for the stockholders and friends of the company has been postponed until such times as the present and proposed construction work is all completed.

The writer is indebted to Mr. Simons, president of the company, and members of the operating force for the many courtesies shown him and for their aid in securing the material used.

Lake View Plant of Le Grand Limestone Company One of Most Modern in Iowa

By W. E. TRAUFFER

THE Le Grand Limestone Company at Lake View, Iowa, operates one of the few modern sand and gravel plants in that state. More or less temporary operations had been carried on at that location for several years before it was decided to build a permanent modern plant. The site is about two miles south of Lake View on the Chicago and Northwestern railway. The property consists of about 110 acres.

The plant which is of Link-Belt design and uses mostly Link-Belt equipment, is a wood-frame structure on concrete foundations. It has been in operation since July 8, 1929, and has a capacity of 30 cars of washed and graded material per day.

The deposit is perfectly flat over the entire property and has an overburden of sandy loam varying from 2 to 3 ft. in depth. The gravel varies in depth to 28 ft. with an average of more than 15 ft. It runs about 35 to 40 per cent gravel of which about 5 per cent is over 2½-in. and requires crushing.

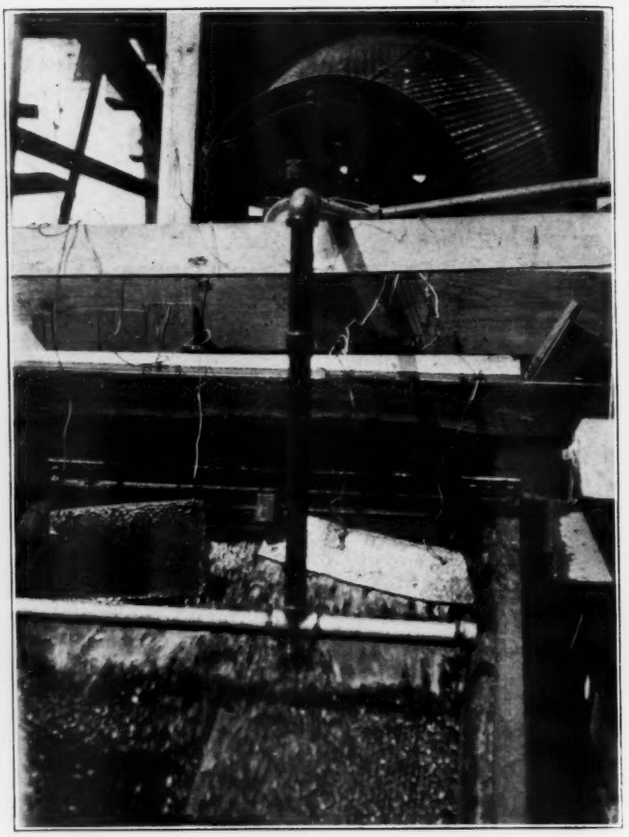
Dragline for loading ballast

Pit Operations

The material is excavated in the pit by a Link-Belt K-55 gasoline crawler dragline operating a 1¾-cu. yd. Page bucket. This is also used for stripping the overburden which is piled off to one side. This dragline was the first of its type and size to be put into operation. It has excavated material to a depth of 28 ft. below the water level while resting on ground 7 ft. above the water. It loads directly into an Iowa Manufacturing Company portable steel bin of 23-cu. yd. capacity which straddles the track leading to the plant. The bin discharges into a train, of two 5-cu. yd. Western side-dump cars, which is hauled to the plant by a Whitcomb 8-ton gasoline locomotive. Another similar gasoline locomotive is on hand to be used when the pit operations move further from the plant.

Le Grand Limestone Company's plant, from south

Discharge from one of the sand separators



A rotary screen and vibrating screen showing water spray

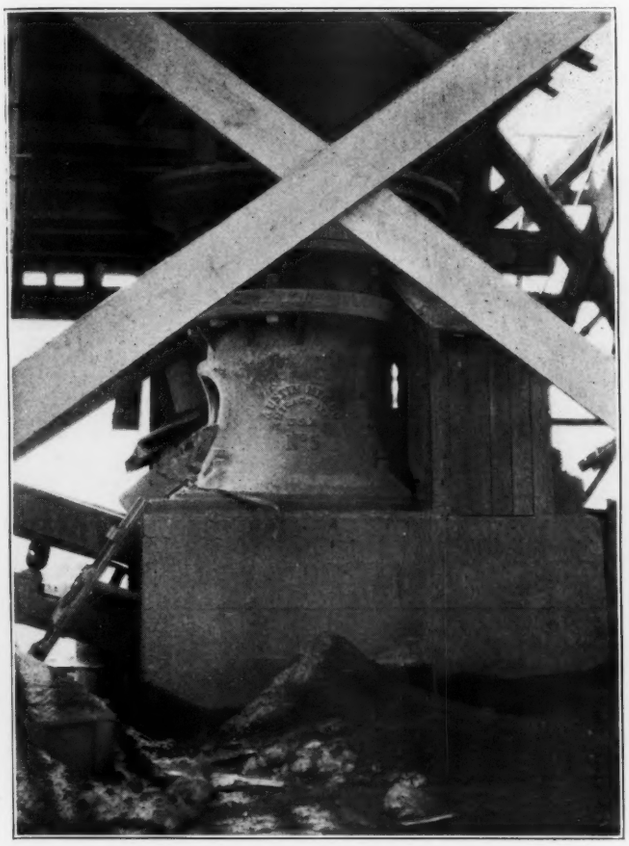
Four new 5-cu. yd. Western side-dump cars will be put into service soon.

Plant Operations

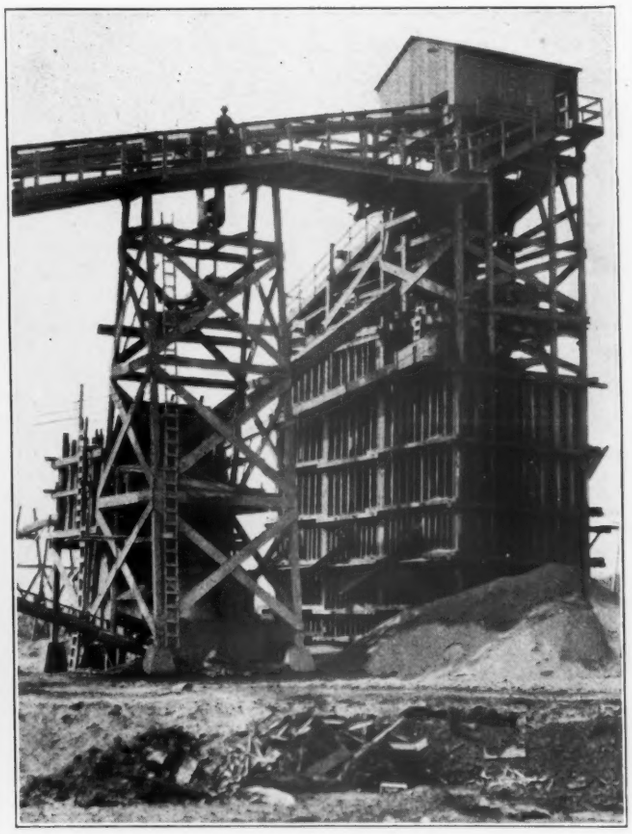
The cars discharge into a concrete track hopper over which is a rail grizzly spaced 8 in. A Link-Belt 30-in. apron feeder regulates the flow of the material onto the main conveyor to the plant. This is a 24-in. conveyor on 250-ft. centers and is driven at its head pulley by a 40-hp. Howell electric motor through a Link-Belt silent-chain drive. The apron feeder is chain-driven from the tail pulley of the conveyor.

The conveyor discharges into two sets of two

Plant from southeast, pumphouse in foreground



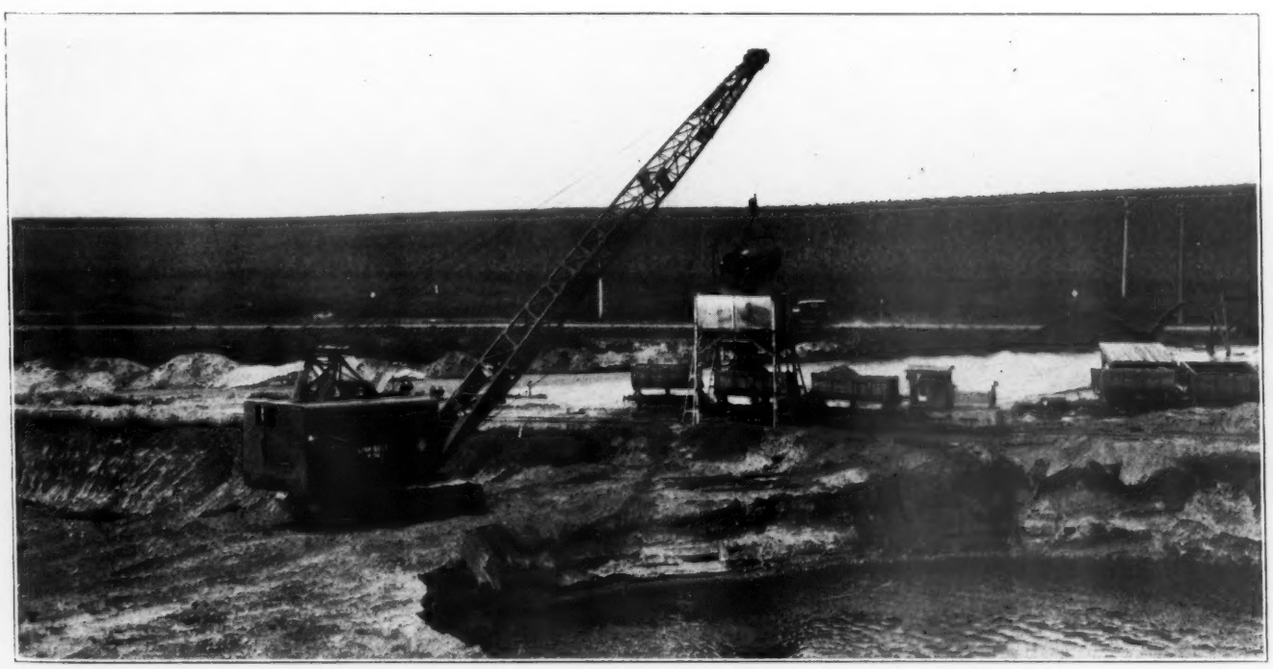
Close-up of crusher



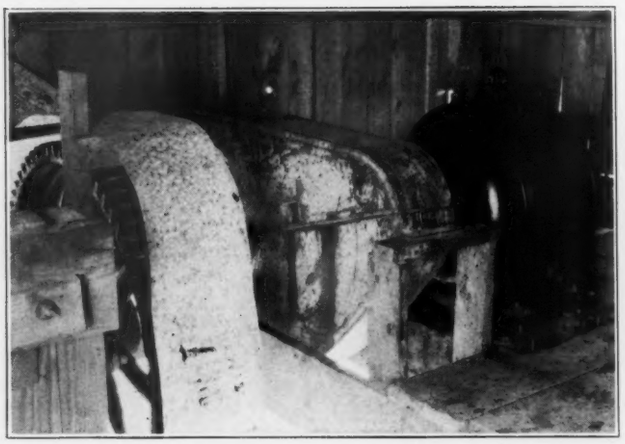
Screening building from northeast

Link-Belt Dull conical screens, each 36 in. by 72 in. by 96 in. These are driven by chain and gear from the same motor that operates the main belt conveyor. The first pair of screens has 2½-in. perforations, and the second pair ¾-in. perforations. Sizes can be varied and mixed as desired, but at present three sizes of material are produced. One of these, the ¾-in. to 2½-in., goes direct to a bin. Another, the mixed material including a gradation of sizes, also goes to a bin.

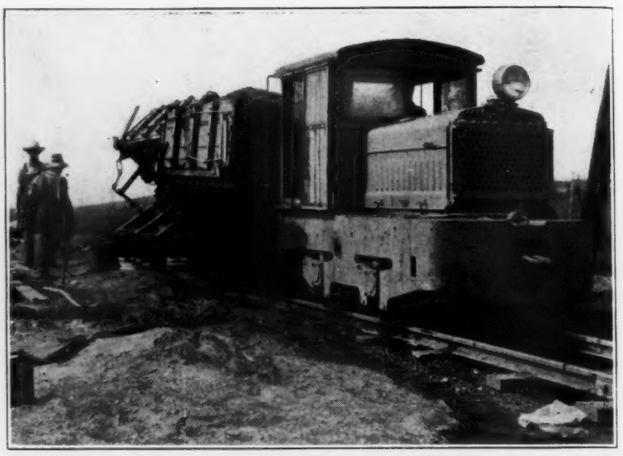
The material passing the conical screens goes to a Link-Belt double-deck vibrating screen with ⅜-in. mesh on the upper deck and ¼-in. on the lower. This screen is belt-driven by a 3-hp. Howell motor.



Dragline loading into track hopper



Silent-chain main conveyor drive



Dumping carloads into track hopper

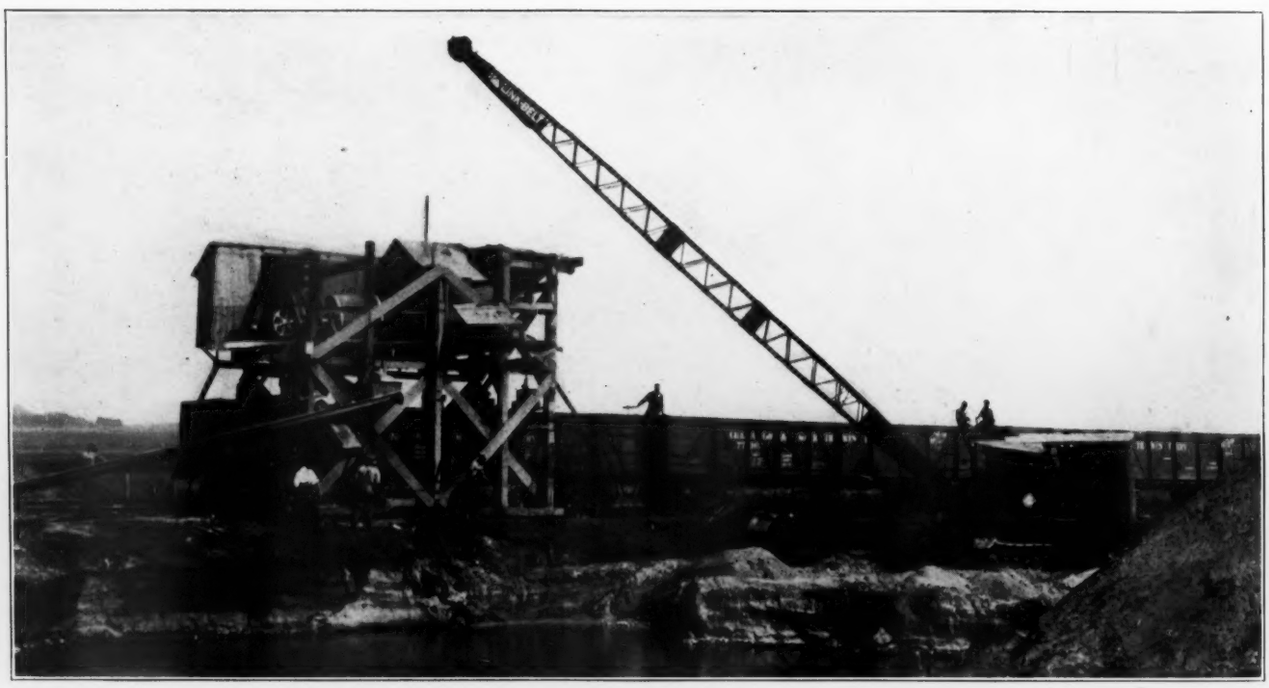
The sand goes through a steel flume to two Link-Belt Shaw classifiers. One of these, a 30-in., discharges through a chute to the mixed bin, and the other, a 24-in., into the sand bin. The three wooden bins have a total capacity of 6 cars.

The material over 2½-in. goes through a chute to a steel-lined crusher hopper, which feeds a No. 5 Austin gyratory crusher. This is driven by a 30-hp. Howell motor. The crusher discharges onto a 20-in. return conveyor on 95-ft. centers, which discharges through a chute in a small frame transfer house onto the main conveyor for resizing. This conveyor is gear-driven by a 7½-hp. Howell motor. Both conveyors have Cincinnati Arno belting. The rollers are Link-Belt with Alemite fittings. The percentage of oversize is so small and the crusher bin of such capacity that the crusher and return conveyor need be run only a small part of the time.

Washing

Water for the plant operations comes from a nearby pit. It is furnished by an Allis-Chalmers 6-in. by 5-in. centrifugal pump driven by a 60-hp. Allis-Chalmers motor and a Fairbanks-Morse 5-in. centrifugal pump driven by a 25-hp. Fairbanks-Morse motor. Each of these pumps has its own frame pump-house, and Iowa Valve Company gate valves are used exclusively. Connection with the plant is through 8-in. and 5-in. lines respectively. Taylor 6-in. American spiral pipe is used throughout because of its combined lightness and strength.

There is some shale present in the deposit. This was formerly picked out by hand by men stationed along the main conveyor. Two 12-ft. Eagle gravel washers, each belt-driven by a 7½-hp. electric motor, now do all of this work and turn out a very clean product. Cars on a siding alongside the plant are loaded through three Link-Belt seg-



Moving rail plant on gondola car

Dumping carloads over grizzly into hopper

mental type gates, two for gravel and one for sand. These gates are 18 in. by 18 in. and are spring-seated. Three similar gates are used for truck loading.

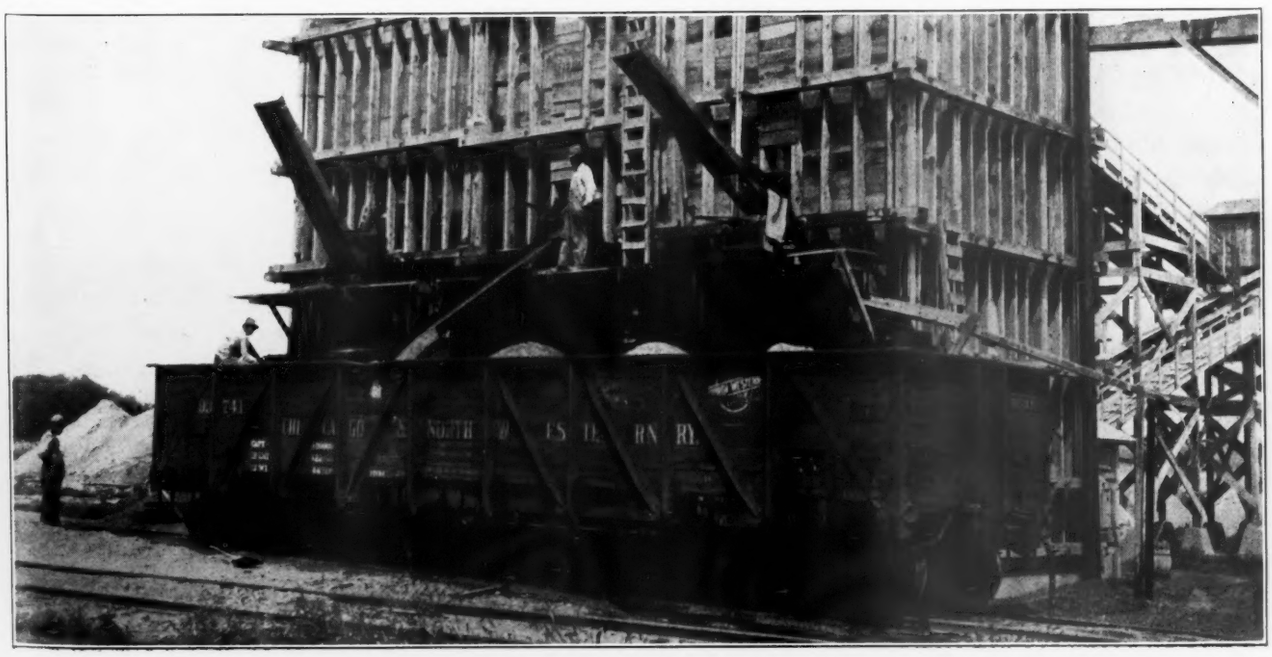
The New Portable Plant

A new portable plant of the company's own design has also been in operation since spring. This is a wood-frame structure straddling the tracks on a siding and is so designed that it can be jacked up on one of the gondola cars and moved to any point desired. It has a capacity of about 15 cars of washed and graded gravel per day. Another plant of similar design which was built several years ago was temporarily abandoned when the new plant went into operation, but will resume operation in the near future.

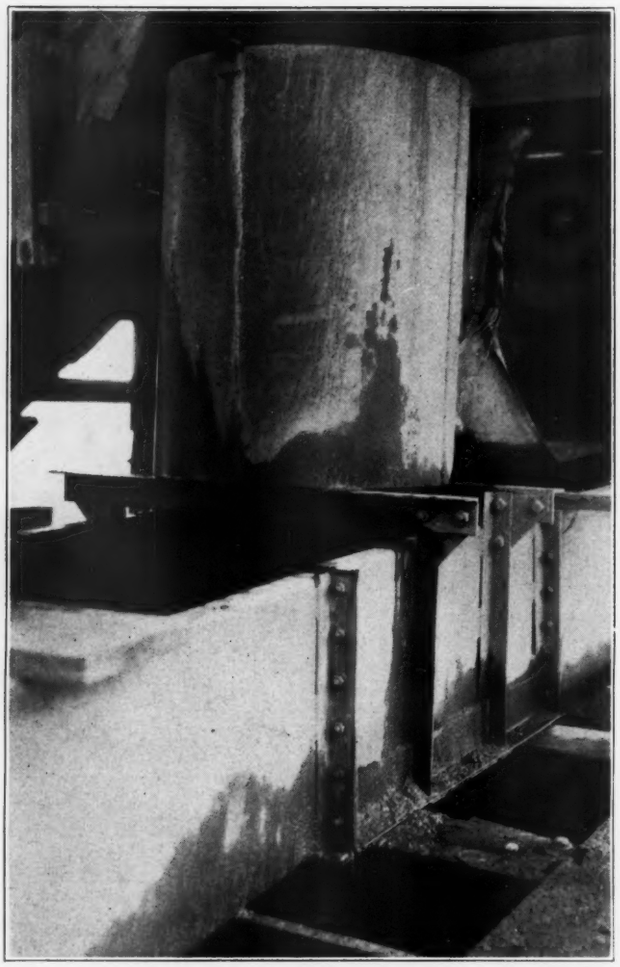
The new portable plant is now located about 1,500 ft. southeast of the main plant. A Link-Belt gasoline crawler crane operating a 1¼-cu. yd.

Close-up of new rail plant

Page bucket on a 60-ft. boom loads the material from the pit into a steel-lined wood hopper at the top of the plant. This discharges through a shear gate into a 36-in. by 16-ft. Iowa Manufacturing Company revolving screen equipped with a 12-ft. sand jacket screened with ¼-in. mesh. This screen



Loading mixed gravel into cars



One of the sand separators

is belt-driven by a Howell 15-hp. motor. The oversize, over 2½-in., goes through a chute to a waste pile, and the fines, under ¼-in., goes with the wash water through a steel flume into an abandoned section of the pit.

The gravel passes over a stationary sand-screen directly into railroad cars on the track under the plant. Several men stationed at this screen pick out any mudballs or shale not removed during the washing and screening process. Jets of water at both of the screens give the material a thorough washing, as may readily be seen from the fact that the product passes the strict tests of the state highway department for concrete gravel. Water is pumped from a nearby pit by a Fairbanks-Morse 3-in. centrifugal pump driven by a 15-hp. motor of the same make.

Ballast Loading Operations

A Monighan gasoline dragline in another part of the property loads pit-run gravel directly into railroad cars to be used for ballast. This machine runs on rollers and operates a 2½-cu. yd. bucket on a 75-ft. boom. It will load out 50 cars of gravel per day.

Shipments are made from the three plants within a radius of 100 miles over the Chicago and Northwestern Railway, which passes the property, and connecting railroads. Most of the washed and graded gravel is used for highway paving the pit-run gravel for railroad ballast. State inspectors are in constant attendance at the main plant, where they have a small testing laboratory.

The Le Grand Limestone Company operates another plant at Le Grand, Iowa. The main office of the company is at 29 South La Salle Street, Chicago, Illinois. R. Winterberg is general superintendent of the Lake View properties and operations.

E. A. Howard is president of the company. He formerly controlled and operated similar companies in Indiana, Illinois, and Wisconsin, and maintained yards for local distribution by trucks of raw materials, this latter practice being chiefly in Chicago.

Use and Care of Tires

Bureau of Standards Circular No. 341, "Use and Care of Automobile Tires," presents useful information relative to tires in general and points out certain precautions, the observance of which is essential to the proper use and care of tires. Brief reference is made to the essential characteristics of fabric tires, cord tires (high pressure and balloon), inner tubes, cushion tires, and solid tires. Detailed instructions are given for the mounting of pneumatic tires. Recommended loads and inflation pressures for pneumatic and solid tires are given in tables, and the general subject is discussed at some length, with special reference to the injurious effects of overloading and under-inflation. The various types of injury to tires and their causes are illustrated and described, and recommended instructions are given for the use and care of tires in general. The circular is concluded with a list of general suggestions, as follows:

(1) Keep tires properly inflated; (2) do not run a "flat" tire farther than is absolutely necessary; (3) see that wheels are in correct alignment; (4) remember that oil, grease, sunlight, and heat are injurious to rubber; (5) spare tubes carried in car should be wrapped or otherwise protected; (6) avoid the use of rusty or bent rims; (7) if it is necessary to use chains, apply them loosely; (8) cut loose slivers from solid or cushion tires—have cuts in pneumatic tires promptly repaired; (9) adjust brakes so that they operate evenly on all wheels; (10) see that tires are properly applied; and (11) drive carefully. Avoid bumps, particularly at high speeds.

General Mica Company's New Plant Salvages Material From Neighboring Clay Operations

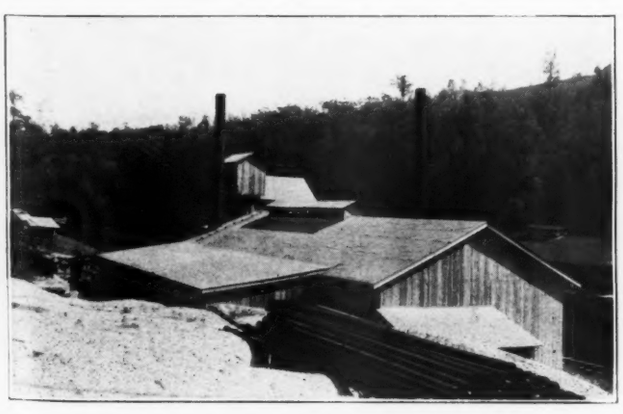
By R. CARL MOORE

THE recently erected Sparks Plant, or Plant No. 3, of the General Mica Company, Penland, N. C., is the newest plant in the country devoted to the salvaging of mica from clay mines as a by-product. The second plant to be erected by this company within the past year, it has profited by its operators' previous experience and embodies the most up-to-date methods employed in mica recovery. The Sparks plant is located along the Clinchfield Railroad, not far from Spruce Pine, and only a short distance from the Toe River. It recovers the mica formerly lost in the waste rejected by one of the largest clay mines in the vicinity.

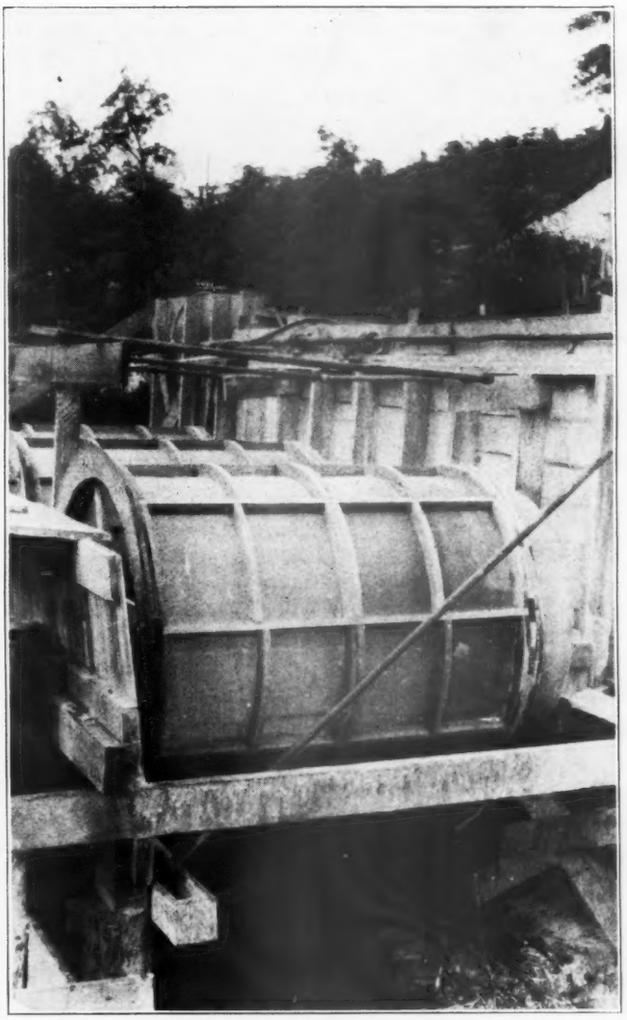
Clay Refining Plant

The clay is mined by hydraulic methods and flumed to the clay-refining plant, situated a short distance above the mica plant. To this clay-refining plant the General Mica Company has constructed flume lines which lead directly into a double-compartment collecting tank. One of these flume lines takes the sludge from the second of two sand-wheels working in tandem in the clay plant. These sand-wheels are large, locally-made wheels with wooden blades that comb the sludge and reject sizable fragments.

The waste from the first sand-wheel comprises the larger pieces of quartz, rock, clay balls, and the like, and no attempt is made to salvage such fragments of mica as might be contained in this, as they could not be handled by the recovery plant. As it is, the sludge from the second sand-wheel contains a considerable volume of coarse material, which flows by gravity into one of the compartments of the collecting tank. The second compartment of the collecting tank receives the finer-mesh waste flumed from the settling tanks of the clay plant. The collecting tank itself is a timber structure, with a floor inclining away from the flume lines so that a free escape is offered the water, and the flow of the waste from the lower end through chutes into locally made revolving screens is facilitated.



Rear of mica mill



Battery of revolving screens

Mica Recovery Plant

The revolving screens with Audobon screen cloth are four in number, each 6 ft. in length by 4 ft. in diameter, and are set at a slight angle from the collecting tank. One screen is 20-mesh and takes the coarser waste from the first compartment; the other three are 60-mesh and handle the finer material from the second compartment.

A free flow of water is essential here; in fact, it is necessary in every step of the recovery process. Therefore, the General Mica Company has set a

Gould plunger pump driven by a 10-hp. Allis-Chalmers motor on the bank of the Toe River, this pump forcing a stream of water through a 4-in. pipe to a water-tank erected on the hill above the plant. From this tank water is drawn as needed to the various points of the flow line.

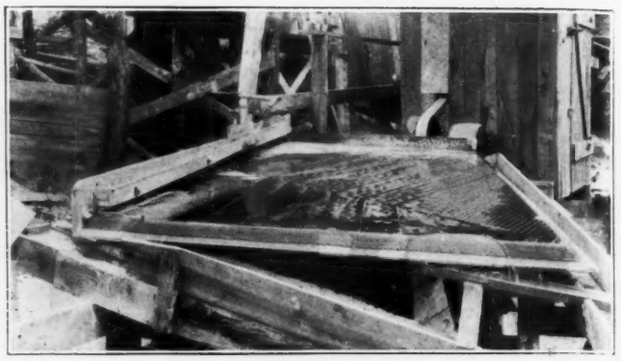
After the extremely fine grains of sand and other foreign substances—which also contain some mica—have been rejected by the screens, the remainder of the sludge from all four screens flows through a trough onto a Deister-Overstrom diagonal-deck concentrating table. This table is of much importance in the process of recovery. It can be raised or lowered at will to any angle to insure a correct flow. It separates the particles of sand, quartz, and other foreign materials from the flakes of mica, and deposits the latter in a trough which leads directly into the main plant. This concentrator as well as the screens are belt-driven by a 10-hp. General Electric motor.

The final processes of refining within the plant itself are, for the most part, similar to those em-

General view of flow line

ployed in the two other plants of the General Mica Company. A description of the No. 2 plant was published in PIT AND QUARRY, October 24, 1928. The flow of material entering the plant is concentrated in four receiving vats extending the entire length of the plant along one side. These vats are so arranged that some can be filled as others are being emptied, while the water is withdrawn below. From these vats the wet mica is shoveled onto the floor of the plant and allowed to leach for a short time.

The mica is next placed on a dryer which also stretches the length of the plant and is about 7 ft. in width. It is heated by a Dutch-oven type furnace, which dries the mica thoroughly in about 24 hours. The mica is then raked from the dryer and wheeled to a bin at one end of the plant. In this bin a bucket elevator operates continually and transfers the mica to the top of a tower, where it drops directly upon a Rotex No. 7 screen. Here it is screened to the desired mesh—usually from 20 to 60—and passes through chutes to the bagging



Concentrating table

room below, the oversize being handled separately.

After being bagged and weighed, it is stored in a large warehouse adjoining. From this warehouse it is loaded directly into cars. Both the elevator and the Rotex in the plant are driven by a 5-hp. General Electric motor.

The plant has a capacity of from two to three tons of refined mica per day. Except for a fireman at the furnace, the plant requires employees during the day only, as the collecting tank is large enough to contain the waste collected during the night.

The mica recovered by this plant is accounted the best recovered by this company. It contains a larger proportion of muscovite or white mica and a smaller proportion of the biotite or dark mica than the average, which means greater purity and a higher luster. This is, of course, governed entirely by the composition of the original schist vein. No method has been discovered whereby the two forms of mica can be mechanically separated. Practically all the mica recovered by this plant is taken by the roofing trade.

Operations at Plant No. 3 are under the superintendence of Clyde Bailey. It should be noted that the clay-refining operations mentioned herein are not conducted by the General Mica Company.

Oofus, a Prehistoric Monster

In the August edition of *Empire State Gravelette,* John G. Carpenter, the editor, says:

"The discovery of several ancient eggs of huge proportions, deep in the glacial sands at Susquehanna, Pa., has created a sensation in the world of science and archeology, and demonstrated that the dinosaurs were preceded by a branch of the reptile family, several times larger, exceedingly more ferocious and more ancient by centuries. The secretary flung the story of this hitherto unannounced prehistoric monster, the oofus, to an unsuspecting world with startling suddenness. The publication of this distinctive discovery was a complete "scoop" on the archeologists, but we do not choose to become a candidate for the Nobel Prize.

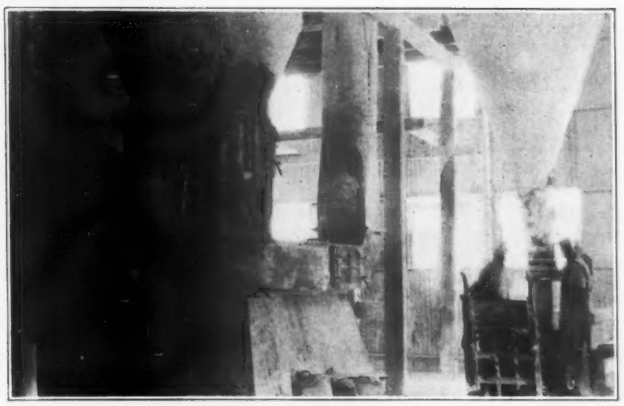
Old Pennsylvania Marble Quarry Now Operated As a Whiting Mine

By R. W. STONE*

IN the outskirts of Philadelphia, near Norristown, Pennsylvania certain rock-rimmed pools of clear, deep water are not favorite swimming holes for small boys, or anyone else for that matter, because, although they may be 200 or 300 feet long and less than 50 feet wide, the rock walls pitch into the water at 60 degrees. One wall is too steep to climb out on, and the other overhangs. These pools are flooded marble quarries. Way back before the Civil War white marble and blue-banded white marble for building purposes came from these quarries in quantity. Much of it was used in Philadelphia. In 1840, Whitemarsh Township, Montgomery County, just east of Norristown, produced marble valued at $30,640, and 50 men were employed in the marble industry. To this day in some parts of Philadelphia, Norristown, and villages near the quarries, one sees many doorsteps, window sills, lintels, and water-tables of sawed blocks of white marble, and the writer remembers one barnyard wall of sawed marble blocks.

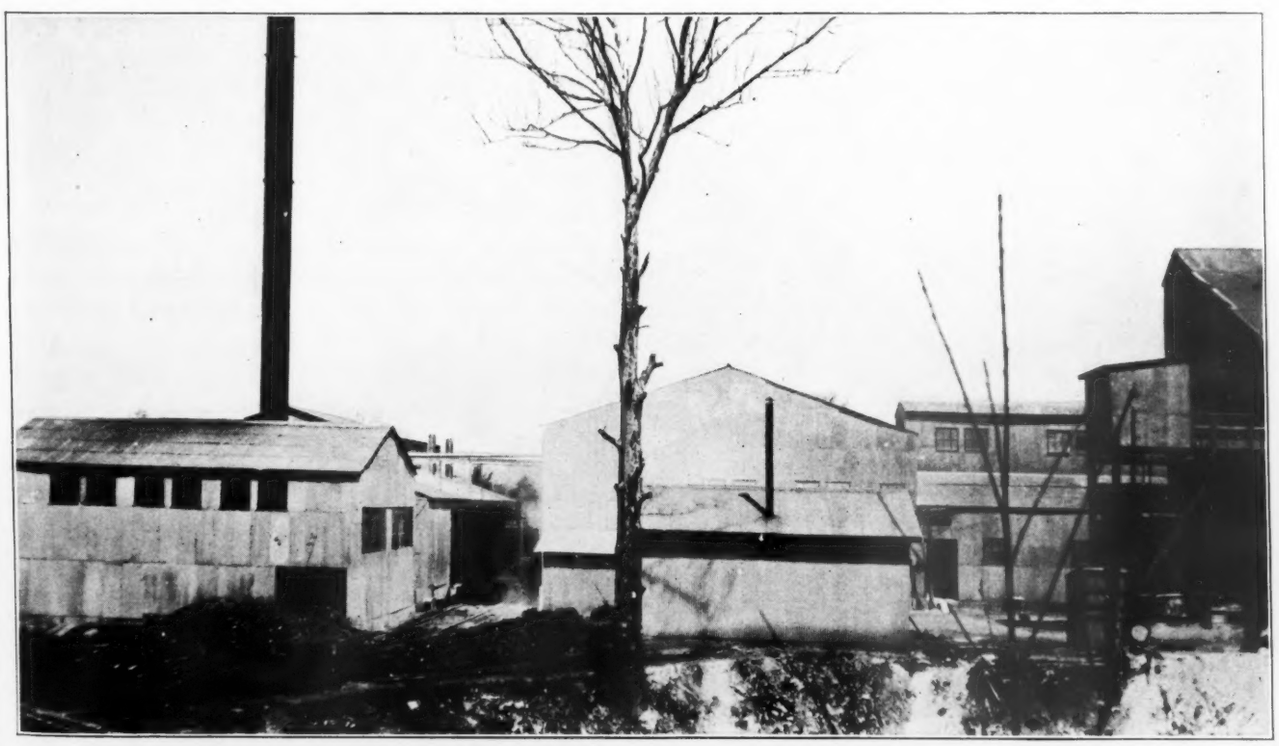
One quarry at Marble Hall was 268 feet deep when its operation was abandoned. The competition of Vermont marble was too much for the Pennsylvania industry and, as one grew, the other dwindled and finally ceased.

* Assistant State Geologist, Pennsylvania.



Pulverizing mill and packer

The Henderson quarry, two miles south of Norristown, after having 100 feet of water in it for more than fifty years, has been pumped dry and is being converted into a mine. In 1926 Thompson-Weinman & Company, Inc., of Cartersville, Georgia bought the property from the Pennsylvania Railroad and proceeded to develop it into a producer of whiting. The mill was completed in September, 1928, and the first car of finished product was shipped in January, 1929. Thompson-Weinman make whiting at two plants—one in Georgia and one in Tennessee—but they have found that freight



Whiting mill. Note freight-car between boiler house and mill

rates to northern markets place them at a disadvantage in competition there with English whiting which is brought to Baltimore, Philadelphia, and New York at a low ocean freight-rate. Therefore, the mill near Philadelphia was built to reduce freight costs.

The old Henderson property contains two parallel beds of marble dipping 60 degrees and separated by 30 feet of dark marble. The white bed is 22 feet thick, and the slightly less white bed, called the blue bed, is 20 feet thick. The blue bed was quarried for several hundred feet along the outcrop, and down the dip to a depth of 110 feet. The quarry on the white bed was much shorter and only about 25 feet deep.

The new owners sank a 70-foot inclined shaft in the bottom of the deeper quarry and are now drifting from the bottom of the shaft. A crosscut has been run at this level to the white marble bed, and drifting is being done on that bed also. When the drifts are beyond the limits of the old quarries they will be under about 180 feet of marble which will be mined by underground methods, including raises and overhand stoping. With a pitch of 60 degrees, the broken rock will slide easily to loading pockets in the drifts. Mine cars dump into a skip running on narrow tracks up the face of the old quarry to the mill.

Primary crusher, from rim of quarry

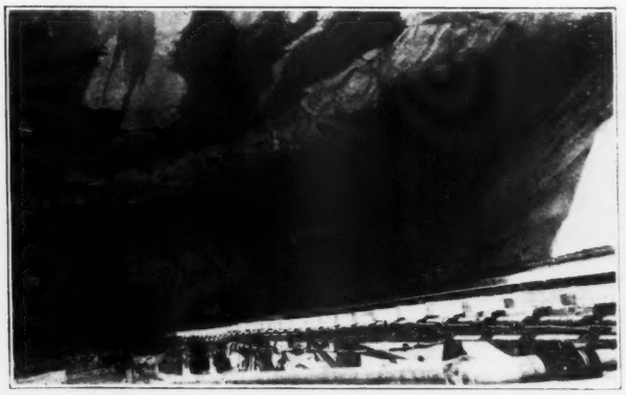
Old marble quarry after dewatering. Shaft sunk at bottom of ladder

Two Ingersoll-Rand bar-and-arm drifters are operated by compressed air from a compressor installed on the old quarry floor. They are now drilling 135 to 150 feet per day in developing drifts. From 75 to 180 sticks of Du Pont, Atlas, and Hercules 30 and 40 per cent gelatine are used to a round of 15 to 40 holes. Each shot is fired separately with time fuses. Air for drilling is supplied by a Chicago Pneumatic compressor.

The mine makes about 850 gallons of water per minute, which is raised by electric pumps, which include Gould, Aldrich, Le Courtney and American Steam centrifugals, all direct-driven by Allis-Chalmers, General Electric and Westinghouse motors. A water vein encountered in the drift spurted horizontally about 20 feet from wall to wall but was successfully plugged.

The mill is a fabricated steel frame covered with corrugated sheet iron. All machinery is on concrete bases, and all moving parts are protected. Electric power is purchased, and the motors are by General Electric Company, Allis-Chalmers, and Westinghouse.

Rock goes from the hoist to a No. 6 McCully gyratory crusher. It is next elevated to bins, from which it is fed to an Allis-Chalmers No. 2 hammer



Looking down, along footwall of old quarry, into shaft

Crusher-house and top of incline

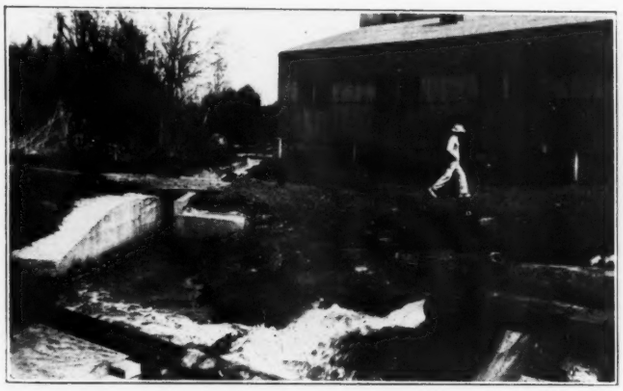
pulverator. Then it is elevated and conveyed to a Raymond storage bin. Thence the rock goes to a 4-roll Raymond impact pulverizer, with air separation delivering the finished material to a bin above the packer. This dry-ground, air-float operation yields a product passing 200 to 300 mesh; its trade name is Norris white.

The plant also makes water-ground, water-floated Paris white. Two Hardinge No. 8 tube mills do the wet grinding. The sludge, after passing cone classifiers, is pumped to a settling tank. The settled material is distributed to a mixing tank and, after thorough mixing, is dewatered in four shell driers. The dried product passes through a beater mill and is conveyed to the packer bin. This wet-ground whiting is 300 to 500 mesh material, or settles in 60 to 90 minutes.

Domestic whiting made at this mill is packed either in paper or burlap bags, to suit the customer.

The home office of Thompson-Weinman & Company, Inc., is Cartersville, Georgia. W. J. Weinman is president and general manager. All sales are handled at the New York office, 52 Vanderbilt Avenue, under S. W. Thompson's supervision.

At the Norristown plant, H. M. Elliott, formerly of Cartersville, Ga., is superintendent and to him the writer is indebted for the interview which furnished the information in this article. George Cotton is mine foreman, and Tom Richardson is mill foreman.



Discharge from mine pump

When in full operation 10 men are below-ground, and 30 to 40 tons of rock are hoisted daily. There is practically no waste in milling, so this means the same quantity of whiting produced by the mill. The mill employs 11 men—2 on the Hardinge mills, 2 on the Raymond mills, 4 packers, a fireman, a dryer man, and a miller. Shipment is by Pennsylvania Railroad, which spots cars at the door of the mill.

Domestic whiting is used as a filler in rubber, asphalt, and linoleum, as an inert extender in oil paint and in making calcimine and cold-water paint. Mixed with raw linseed oil it makes putty. It is used also as a mild abrasive, in dressing for white shoes, in the coating of glazed paper, and for many other purposes. The product of this mine is sold principally to rubber manufacturers. The off shades are bought by sheet-top asphalt companies.

If a mine or a mineral deposit has a spirit or guardian angel, how pleased that spirit must be with the sound of drills and the rumble of mills after so many decades of quiet, submerged in a rural pond. The spirit's rejoicing at release is restrained, however, by the complaints of neighbors against blasting. If Congress while legislating for farm relief will make some provision for the relief of miners also, some of the little mineral industries will have a better chance to survive.

Record Year in Canadian Sand-Lime Brick Industry

Production in the Canadian sand-lime brick industry established a new record in 1928, according to official figures recently made public. Output in the year amounted to $1,112,466 as compared with $939,991 in the previous year and $629,672 in 1926. Production included 82,271,000 sand-lime bricks, valued at $1,038,510, as against 72,864,000 bricks, worth $864,911, in 1927. The balance of the output consisted mainly of hollow building blocks. Eleven plants were operated in the year under review, seven being in Ontario and two each in Quebec and Manitoba. Capital engaged in the industry totalled $1,916,060.

System in Hiring the Employee

By J. J. BERLINER

BECAUSE so many of the results of personnel work are slow to develop, it is often difficult for the employment department to gain a foothold. This is particularly true when the employment manager undertakes his work without wide experience or definite preparation for the position. The suggestions which follow are intended to bridge over this gap. The methods described should be regarded as preliminary to a more thorough analysis. Their simplicity and directness will recommend them to those who are striving to adjust themselves to a new situation. The results are quickly attained and sufficiently exact to show immediate results for the doubting Thomases among other executives who are watching the experiment.

In most establishments, when the employment work is first started, there will be found a certain restlessness among the employees. It may be in various forms, such as men quitting or being discharged, or a shifting from one department to another, but in whatever form, whether known as turnover, absenteeism, tardiness, transfers, or promotions, it is the duty of the employment manager to know that the movements are justified and in accordance with good business. It is always unwise to assume because a condition exists in an establishment, that it cannot be corrected when it has been thoroughly investigated.

For the sake of convenience we will suppose that we are working in a plant which is divided into about 30 or more departments. Skilled and unskilled workers are used. The foremen have been doing the hiring and firing, as well as all of the industrial relations work that was being done.

The employment manager will want to get a grasp of the situation quickly in order to know just where to direct his immediate efforts.

Information in Regard to Workers

About the first move to be made will be a study of the present methods, if there are any, for collecting information in regard to the workers. Some foremen are systematic in this respect and have a private record of their own which is not a part of any record or system carried by the company. It is usually wise to get all of this information that can be secured and incorporate the good in the new methods.

If the employees are leaving rapidly, it will be necessary to know the reasons why they are leaving, whether they are high or low-priced men, and how long they have been in the employ of the company. The reasons for leaving can only be secured by an interview of some kind. It may be with the employee leaving the service, a foreman, a fellow worker, a friend, or someone outside of the plant. It does not matter so much from what source you get the information as it does that you get the correct reasons. The aim should be to get them from the employee leaving, but many times he will offer excuses that are in no way helpful in solving your problems.

If a dead file of pay-roll cards or other employment records is maintained, and there are no figures to show the amount of turnover by departments, a tabulation can be quickly made which will locate the spots where most of the trouble originates. The tabulation should show the number of employees terminating employment in each department during each six months' period for the past three or four years. By ruling a large sheet in good-sized squares, with the departments listed on the left margin and the time periods across the top, the tabulation can be taken very rapidly from the cards in the dead file by making tally marks in the appropriate squares. Note from each card the date of termination and the department, and enter on the chart accordingly.

Analysis of Length of Service

It is usually advisable to supplement such a tabulation with an analysis of the length of service of present employees. This can be taken from the live payroll cards on a sheet similar to the one described above except that the length of service is substituted for the dates of termination at the top of the chart. It is usually sufficient to tabulate length of service as follows: Less than six months, six months to one year, thereafter on one-year periods up to "10 years or over."

The other essential facts, such as how many are leaving, whether they are high or low-priced men, and how long they have been in the service can be secured very easily and quickly by using some simple form such as shown in the accompanying chart for keeping track of changes as they occur.

This form may be used in several different ways. If it is to be used on the employment manager's desk in order that he may refer to it quickly, or

if he wants to make his own tallies, it could be operated somewhat similarly to a pin-board plan; but, instead of using pins he could make dots with a pen or pencil. It can also be operated to show totals for the day, week, or month.

This form, if operated correctly, will bring several interesting features to the surface. At the top of the form, from left to right, are the different rates of wage paid per hour. They are arranged in order from the lowest to the highest. On the left is the length of service arranged in any periods which may be thought best for the plant. On the right is a total column for length of service and at the bottom is a total column for the number of employees for each rate. Each of these total columns should balance with the total in the lower right-hand corner.

An examination of the chart will show that most of the employees for the period covered by the form have left before they have been with the company one month. This would indicate that the employment manager must devise some means of getting some quick work across to the workers before the first ten days have passed. What it should be will depend entirely upon the reasons for leaving, but whatever it is it must reach the new men quickly.

Classification of Separations

We would like to know how many employees, by classes, are leaving. That is, how many common laborers and green helpers, how many trained or experienced helpers, and how many tradesmen.

The highest rate paid a green helper is 55 cents an hour, so we draw a dotted line at the bottom after the column for the 55-cent wage. The highest rate paid experienced helpers is 78 cents an hour, so we draw a line after it. The balance are experienced tradesmen. By adding the figures between the dotted lines we have 50 for common laborers

SEPARATIONS

From Feb. 1 to Feb. 10, inc., 1929

LENGTH OF SERVICE	RATE OF WAGE PER HOUR																		TOTAL FOR SERVICE
	0.40	0.45	0.48	0.50	0.52	0.55	0.60	0.62½	0.75	0.78	0.80	0.85	0.87½	0.90	0.95	1.00	1.12½	1.25	
Failed To Report	2												1						3
Less Than 1 Week	1	7	2	5	3														18
1 Week	5	1	7	4	2														19
2 Weeks			2	4			2												8
3 Weeks				1		2		1											4
1 Month											1								1
2 Months							1							1					2
3 Months										2									2
6 Months																	5		5
9 Months				1					1				1						3
1 Year							1					1							2
1¼ Years										1					1				2
1½ Years					1														1
1¾ Years																1			1
2 Years																		3	3
3 Years									1										1
4 Years															1				1
Total By Rates	8	8	11	15	6	2	4	1	2	3	1	1	2	1	2	1	5	3	76
					50				10								16		
Per Cent					65.8				13.2								21.0		

Suggested form for recording term of service, showing total separations by periods

and green helpers, 10 for experienced helpers, and 16 for tradesmen. When we put these on percentage basis we have 65.8, 13.2, and 21.0 per cent. The workers drawing the lowest rate constitute the largest percentage. That is the way it should be, but perhaps the proportion is too great. The question that these figures raise is why are there more tradesmen leaving than helpers?

Another interesting feature is that 34.2 per cent of the separations were trained men, a rather serious condition unless justified in some manner. A concern cannot afford to lose the employees it has developed and trained.

Although turnover will never be stopped, and we must have a few high-priced men leave to stimulate promotion when a business is not growing very rapidly, the aim of the employment manager should be to confine the turnover to the workers that are least expensive to the business. Whether this is being done or not can be quickly determined by drawing a square in the upper, left-hand corner. You will have to decide upon the period and rate to use, but for convenience the three-week period and common labor and green helper class is used in the illustration.

The ideal condition from a cost point of view would be to have the turnover in that square and the ones in the square diagonally across from it would be the serious losses. The column on the right will show the number of employees leaving the service by periods of employment. The line on the bottom will show the number of employees leaving the service and the rate of wage.

This simple form will furnish enough information for the beginner to direct his efforts. It is not necessary for him to know definitely how much it is costing the company. Approximate figures will answer until better conditions prevail. It is not as important to know that it cost $50 or $100 by losing an employee, as it is to know why he left and if possible prevent its happening again.

Figuring costs for turnover is a very intricate and difficult thing to do. So many of the figures are not obtainable and must be estimated. If part of them must be estimated there should be no objection to estimating the others, so far as accuracy is of value. Very few concerns have a cost system established that will furnish these figures in complete form.

Study of Absenteeism

Absenteeism is, in a mild form, akin to turnover. In-so-far as getting out production is concerned, there is no difference. The man is not working and another worker must do it for him or it is not done. If another worker is shifted over some one must do his work, and so it shifts on down the line. If a worker attempts to hold down two men's work then each job suffers. In either case it reflects on the cost of production, but so few cost systems can produce the effect that it goes on as a just charge against production.

There are many reasons given for absenteeism. Some are good and justified while others are excuses and not reasons. Sometimes tardiness develops into absenteeism. The writer has known of cases where men have started for work and have been delayed by transportation facilities until they turn and go home instead of coming to work so late. Some workmen have an objection to coming to work late but do not have the least objection to taking the day off.

Recording Absences

Some people would recommend that a record be kept of time worked by each employee. With a condition such as we have mentioned, such a system would entail considerable work. As we must work on other angles at the same time, a very simple way to check the chief offenders would be to have the paymaster furnish every morning a list of men who did not report for work. If you do not see fit to have the worker report to you before going to work, you can start a small set of cards: one for each worker as he is reported, on which can be recorded the number of absences. When the second absence is reported for a worker an effort should be made to ascertain the cause. In this manner it will be possible to confine your entries to the workers that are losing time. If the information secured is of sufficient importance, a permanent record can be made of it; otherwise it is better that it be forgotten.

There is no reason why a concern should fill its files with information it will never use. This statement does not mean that it should be carried so far that insufficient information is recorded for solving problems, but there are some things that happen in industry that have no place whatever on paper.

Tardiness, like absenteeism, is in a sense related to turnover. One who comes in late is in a small degree a part-time worker. It is not always an easy matter to break up coming in late, and many times it is due to conditions beyond the control of the worker. Then, on the other hand, there is the worker who is constantly late; the one who waits until the last minute to start for work. In order to determine what to do it will be necessary to secure the facts, and they can be obtained in the same manner and on the same set of cards as are used for the absenteeism records.

Transfers and Promotions

Transfers and promotions should be watched and recorded. It is not always the good worker that is changed. In plants where there is no central control many inferior men are transferred in order to get them out of the department in which they

are working. Some foremen will try to justify such a move by saying, "Oh, well, he may make good over there," and then there is the conscientious foreman who would not agree to let a man have an opportunity to make good in another department because he is not making good where he is. Either of these standards is wrong, and it sometimes requires a long time to win the foreman around. Some are like children; they do not want to take medicine for their sickness.

Most of the trouble with new employment managers is that they want to do too much at the beginning. They want to know all about and put into effect the many more refined phases that the more experienced employment men talk about, many of whom do not have these refined phases working successfully in their own plants.

To talk about systems and plans is one thing; but to make them work successfully is another.

If the employment manager will be satisfied to give his problems constant and serious thought, be satisfied to put over one thing as the opportunity will permit and hold off with the others there will not be much doubt about success.

The Art of Interviewing

The first pre-requisite of an interviewer is common sense. Lacking this, I know of no qualification or group of qualifications that will serve as a substitute for it.

A successful interviewer must be one who:

1. Can put an applicant at ease.
2. Can get the greatest amount of information without resorting to rapid-fire, third-degree methods.
3. Can retain facts clearly until such time as the application is made out or the applicant is rejected.
4. Possesses imagination and quick despatch without resorting to snap-judgment.

1. If, as an interviewer, you find that the man to whom you are talking shifts from one foot to another, shifts his hat from one hand to another, in a word, that he is ill at ease, you may believe that you lack this first qualification mentioned. To begin with, you must come down to his level without putting yourself into his class. Loosen up those tense facial muscles. Let out a little smile. It works wonders. Obviously the best results cannot be obtained from a man who feels abashed, whose mind is not functioning normally.

If the lapel of his coat shows he is a discharged service man (and certainly a very considerable per cent of applicants are in this class), notice it. He wants it known, otherwise he would not be wearing the button. If, then, he wants it known, why pass over it as though you did not see it? There are a dozen whimsicalities that will break the ice and prepare a man for the grim business of questioning. Did you ever try guessing their first names when you start talking to them? Ninety-eight times you will be wrong and twice you will be right. You must be cock-sure about it, too. Human nature enjoys seeing the cocksure man go wrong.

Because you have stepped up to interview thousands of others before this man approached you, may be reason enough for calling it monotony, but that is no excuse for the interview being dull and commonplace.

Again, I say, if you want to get the best out of an interview, put the applicant at ease. Relax those muscles that are gripping him around his windpipe and get the blood moving normally through his brain. Then there is an even chance of his real self coming out.

Tactful Questioning Brings Results

2. An interviewer must get the greatest amount of valuable information without resorting to rapid-fire questioning. This is by no means easy. Here particularly, tactfulness must be used for you must not "cut" him short and certainly you cannot let him wander on aimlessly telling about his former places of employment, the foreman who could not understand him, or what a marvelous piano tuner he was until his hearing went back on him and he had to take up pipe-fitting. Tactfully, the interviewer must guide him along the right path and confine him to the facts he really wants to know, without making him feel that he is being "let down" abruptly or with discourtesy.

3. An interviewer should possess a retentive memory. If he does not, he should train himself to this end. When the interview is finished he should know that John Doe lives at 89 John St., is 34 years old, is married and has three children, is an American citizen, that he served his apprenticeship with Jones & Jones, at 29 9th St., and later worked during two years for Franklin & Co., as a machinist. John Doe hardly realizes that he is giving you this information as part of it comes by direct questioning, but most of it comes unsolicited in the course of the conversation. With one or two supplementary questions you have all the information you require for his application card which becomes his personal record card when he enters the employ of your concern.

The practice of making a man a target for a dozen rapid-fire questions to supply the information for an application form after the interview is completed, is bad practice and is resented by the applicant. Allowing a minor clerk to quiz a man for this purpose ought to be discouraged as much as possible. The manner in which this is done frequently offsets the good accomplished by a successful interview. The logical man to make out a pencil or pen copy of the application form is the one who interviews, for he already has 90 per cent of the required information.

Too Much Efficiency May Prove Uneconomical in Practice

By W. F. Schaphorst

High efficiency is a good thing provided it is economical. But there is such a thing as carrying high efficiency too far.

An efficiency of 100 per cent is unattainable. Yet nearly every manufacturer of machinery involving efficiency, whether mechanical or electrical, is striving for that unattainable ideal—absolute perfection. It can't be done.

One manufacturer went so far, not long ago, as to actually advertise the attainment of 100 per cent efficiency. It was perhaps within his legal right to make such a claim but it seems to me he went too far when he stated that similar competing products showed efficiencies of only 75 per cent to 80 per cent. My opinion is that any concern claiming an efficiency of 100 per cent for its product is certain to arouse suspicion and as a result will lose rather than gain business. I wrote to the manufacturer asking for complete information regarding the claimed efficiency, but it was never made clear to me. I did receive a courteous reply to my letter, but the difference in efficiency was not explained, nor was I told how such a high efficiency was attained.

Many claims for gear transmission efficiency, also, are unnecessarily high. An accurately made gear can have a transmission efficiency as high as 99.5 per cent, but of course gears as efficient as 99.5 per cent are exceptional.

The efficiency of a first-class silent-chain drive can be 98 per cent or even 99 per cent. The efficiency depends largely upon prevailing conditions. One prominent manufacturer said to me: "If we were to be very conservative, we would say the efficiency of our chain varies from 95 to 98 per cent, depending on varying conditions." That surely is conservative.

As I have already said, to claim 100 per cent efficiency is absurd. Any engineer of experience and standing realizes that one cannot use a given amount of power to accomplish a given amount of work without some loss due to friction. In other words, you apply a certain amount of power to move certain elements.

One prominent chain manufacturer wrote to me recently, "We have recorded efficiencies very close indeed to 100 per cent, and upon one occasion we had an efficiency of over 100 per cent, but an analysis showed a slight variation in electrical voltage to be responsible for this efficiency." It is well that he checked the results.

Nor are manufacturers of mechanical transmission the only offenders. Not long ago a manufacturer of electrical equipment came out with a statement in which he declared that he produced the most efficient drive in industry. The claim didn't sound just right to me, so I wrote for complete information. I received literature from the manufacturer which I studied carefully. It was perfectly evident that the writers of the literature themselves knew that they were making extravagant claims because, on the very first page of reading matter, they made an attempt to "explain" their interpretation of the meaning of the word "efficiency." They said that the word "efficient" has come to mean a great deal more than the strict engineering use that involves only "the ratio of output to input." They claimed that, in determining to what degree a machine is efficient, the present day executive considers: first cost, space occupied, continuity of service, maintenance expense, operating expense, length of life and suitability for the service intended. They stated that these points must be kept constantly in mind when investigating the relative merits of possible installations with a view to determining which is the most efficient. You see that they really endeavored to create a new meaning for the word "efficiency," which, of course, is not so easily accomplished in this day and age.

Efficiency always has been and always will be equal to "output divided by input." Thus, if an engine is delivering 100 hp. to its flywheel and if that flywheel is belted to a driven pulley, and if we can get only 98 hp. out of the driven pulley, the efficiency is $98 \div 100 = 98$ per cent. Efficiency has positively nothing to do with first cost, space occupied, continuity of service, maintenance expense, operating expense, or anything of the sort, and don't let them tell you differently. On reading further into the publication, I found that it related solely to electric motors. They claimed a power factor of 100 per cent for such motors, which of course is very good. But that doesn't prove that the efficiency of electric motors is 100 per cent. In fact, according to their own diagrams, the efficiencies of their motors vary from about 92 per cent to 94 per cent. I know many drives that can beat 94 per cent all hollow. Therefore their claim was an exaggeration.

Knowing that large electric motors are always more efficient than small ones—in the same way that large steam turbines, large engines, large pumps, large air compressors, large **everything**, are more efficient than small ones—I carried the investigation further. I found that small 1,800-r.p.m. synchronous motors of about ⅛ hp. have an efficiency of only 50 to 52 per cent. Just jot that down in your note book, or in your memory! I doubt whether any belt, hydraulic drive, chain, rope drive, or gear, has ever sunk as low as 50 per cent in efficiency.

Extravagant claims don't pay. Go too far and nobody will believe you. Besides, high economy is always more important than high efficiency. Sometimes high efficiency is expensive.

Diesel Engines—Their Present and Possible Applications in the Pit and Quarry Industries—I

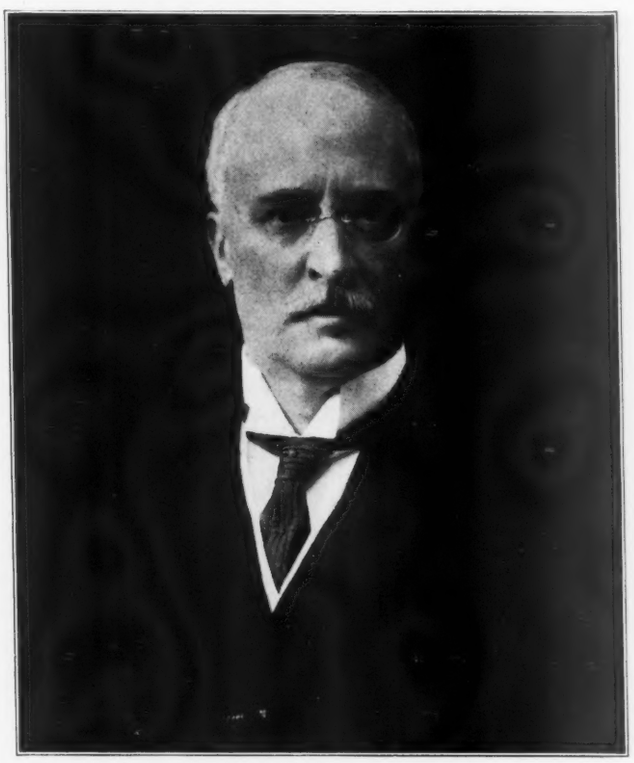
A Short Historical Sketch of the Development of Oil Engines and Descriptions of Different Types Which Are Adapted to the Pit and Quarry Industries

By J. O. DURKEE

OIL engines are so widely used that it is impossible to enumerate the hundreds of classifications of their service. More than 30 years of development along various lines of research covering engines adapted to the use of the cheapest, heaviest and most universally obtainable oils have effected efficiencies and advantages that a few years ago would not have been considered possible, especially in the pit and quarry field.

At present, diesel engines are used to operate air compressors, well drills, hoists, cranes, clamshells, shovels, draglines, locomotives, tow boats, dredges, self-unloading boats, pumps, crushers, elevators, and concrete mixers, and they are especially economical in operating electric generators. Many operators are using them as stand-bys in case the purchased power is accidentally cut off.

As a prime mover, it passed the experimental stage many years ago and has recently reached the place of a highly specialized machine for the pit and quarry industries. New applications of diesel engines are being made, and their successful applications are constantly being demonstrated. They involve producers, by decreasing overhead and increasing production, and manufacturers, who are building equipment especially for this field.



Courtesy Busch-Sulzer Bros. Diesel Engine Co.

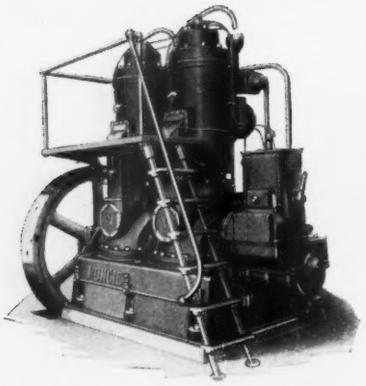
Dr. Rudolf Diesel

Dr. Diesel was a German engineer, born in Paris, March 18, 1858. His principal achievement was the invention of the diesel oil engine, though he did not live to see its possibilities fully exploited. He fell overboard the Antwerp-Harwich mail steamer on the night of Sept. 30, 1913.

According to G. B. Massey in the 1929 Pit and Quarry HAND-BOOK: "The diesel principle, called after Dr. Rudolph Diesel, who built his first successful engine in 1897, is the most economical method by which fuel may be converted into power. Air compressed to about 500 lb. per square inch in the cylinder by the up stroke of the piston reaches a temperature of about 1,000 degrees Fahrenheit. This temperature is high enough to ignite the fuel charge which is sprayed into the cylinder near the upward point of the stroke by compressed air. The fuel charge enters the cylinder gradually and in very small particles mixed with air. There is no explosion, but a gradual burning of the charge, which still further heats and expands the air which drives the piston downward."

For the true diesel engine, no timer, magneto, hot plate, hot bulb, glow plug or other incandescent interior surface is required, nor is any heater, vaporizer, carburetor or other fuel mixer used in any way, either to initially start or to operate it. Diesel engines differ radically in this respect from all other internal combustion engines.

Air is supplied on the four-cycle type through the usual arrangement of valves in the cylinder head. On the two-cycle types it is supplied usually from the crank case, or from a large cylinder operated in line with other cylinders. This is necessary on extremely large cylinder sizes, because sufficient air cannot be delivered by the large crank case at a pressure required to both support combustion and make the air penetrate the large cylinder volume so as to scavenge the cylinder of burned gases. The extra cylinder is therefore supplied with its additional component parts to operate as a compressor, which absorbs approximately 10 per cent of the engine capacity. The air from the compressor discharges in a large reservoir built alongside the cylinders so



Muncie Type V diesel, made in sizes from 45 to 360 hp. and in multiple installations up to 1,000 hp. or higher, as desired

that the air may be admitted to the combustion region in the usual manner of the two-cycle crank case scavenging engine.

The fuel injection nozzle of any diesel engine is a necessary part and its construction varies with the style of engine design, some being very complicated and requiring intricate operating mechanisms, while others are exceptionally simple.

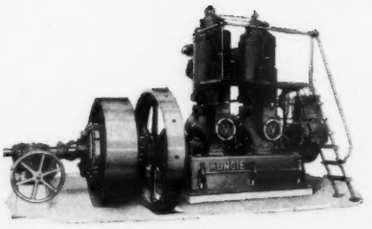
In all diesels the fuel is admitted only at a point when compression is at or near the highest point. It must be admitted with sufficient force to overcome the compression pressure and penetrate in a fine spray to make it burnable quickly and completely. The methods employed in injecting the fuel divide diesel engines into two classes, the air injection, and the airless or solid injection diesel. Both of these classes have been highly successful as well as a number of semi-diesels, depending on design and local conditions.

The Air Injection Diesel

For this type, injection is accomplished by air at a pressure of 1,000 to 1,200 lb., which is applied to the charge of fuel in the nozzle forcing it through small openings and depositing it as a spray of oil vapor and air into the compressed charge of air in the cylinder. The injection air pressure must be about twice that of compression and requires a multi-stage compressor, usually built integrally with the engine.

The Solid Injection Diesel

Many diesels are of this type and accomplish injection by mechanical pressure applied to the fuel to force it through the atomizer nozzle. Because no air is employed, it is called the airless injection diesel and is commonly termed a solid injection diesel, although the fuel is not injected as a solid liquid mass as the term might imply. The oil is as finely atomized as in the original type. Certain manufacturers claim that the fuel is more easily ignited without air which many engineers believe has refrigerating effect when exhausted from exceedingly high pressures. The two systems at present used for injecting fuel without the air are distinguished by the terms impulse injection and accumulated injection.

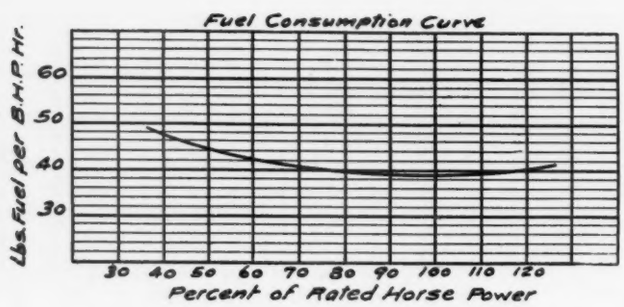


A Muncie in operation

With the impulse injection type, there is a pressure rise of the fuel for each impulse of the nozzle. This is obtained through a single pump acting on each nozzle at the time injection is desired. The fuel pressure lifts the nozzle valve automatically and the period of injection is timed at the pump, controlled by the governor, or both.

The amount of fuel may be regulated by reducing the actual stroke of the plunger, or it may have a continuous stroke for all loads and the governor act to reduce its effective displacement by having a cut-off either at the latter or foremost part of the stroke. This is frequently accomplished by a by-pass valve functioning, during the latter part of the stroke under governor control, by controlling the suction valve by the governor or the length of the suction stroke of the injection pump plunger being controlled by the governor.

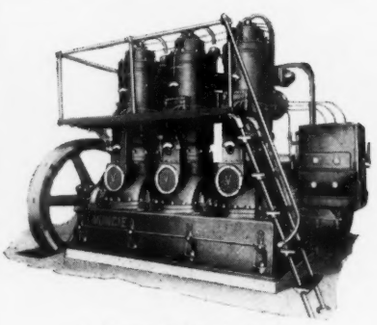
With the accumulator injection, the fuel is maintained at almost a constant pressure by one or more pumps delivering the fuel to an accumulator or reservoir. The fuel is readily delivered to the nozzle at such pressure as required to inject it through the mechanically-operated and governor-controlled valve in the nozzle.



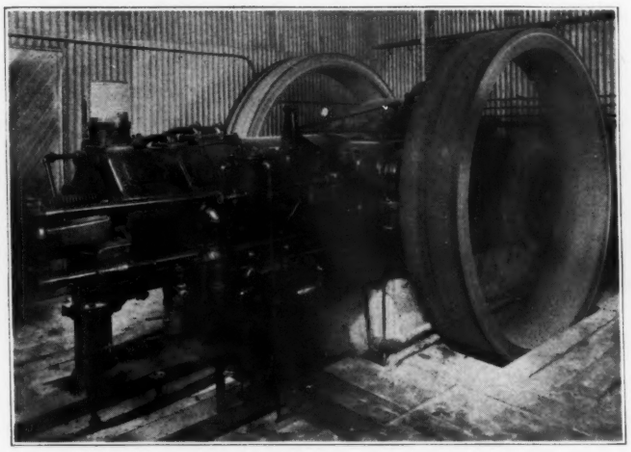
Supplied by Buckeye Engine Co.

Age of Oil Engines

Many different types of oil engines have been used at different periods, and, although Dr. Diesel invented the engine which bears his name in 1897, the first commercial installation was made in the United States in 1893. Not much progress was made from that time until about 1912, when a number of



A Muncie built engine



A 150-hp. Type PO Ingersoll-Rand solid-injection engine at a Maryland quarry

improvements again focused attention on this type of power. The progress since that time has been rapid, until today engines of more than 4,500,000 hp. are in marine and stationary service. Of this total, the United States has about 3,000,000 hp.

In addition to its low operating cost, the diesel engine has the interesting characteristic of being just as efficient in small sizes as in large units. The largest engine to date is the 15,000-hp. unit installed in a German power station. Units of 5,000 to 8,000 hp. are becoming common in the marine field. It makes little difference whether the engine is 50 or 10,000 hp., it has the same high efficiency, according to claims made by many engineers.

Because of the simplicity of the diesel engine with its elimination of any kind of ignition system or carburetors, it has established some remarkable reliability records. Many instances have been recorded of diesel engines that have operated continuously for more than a year without a single shutdown. Practically all the first diesel engines installed in the United States some twenty-five years ago are still in operation.

Diesel engines are attracting considerable attention in the pit and quarry industries, and installations of this type of power are becoming frequent. As their practicable service in the many ways in which power is required in these industries is demonstrated, they are sure to be used more generally.

In addition to encouraging the wider use of this efficient prime mover, the manufacturers are also giving more attention to better diesel power-plant design. Although the diesel engine is a simple type of prime mover, its satisfactory operation depends on good plant layout. Cooling water and lubrication are especially important in this field and the layout of cooling-water systems has had considerable study. The use of lubricating-oil purifiers of various types and the development of completely automatic lubrication systems have eliminated difficulties in this phase of plant operation.

We quote from a reply to an inquiry received from C. K. Smullen of the Oil and Gas Engine Department, Ingersoll-Rand Company, as follows:

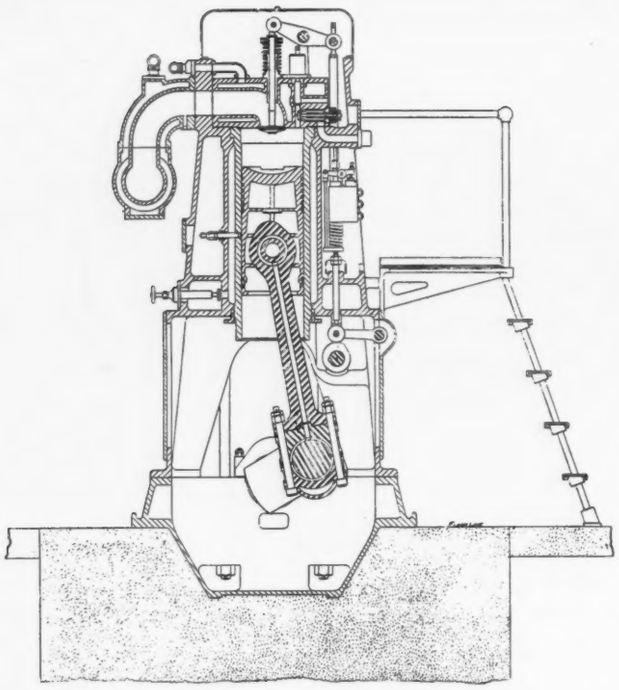
"I can well agree with your statement that diesel engines and diesel engine driven equipment have not been generally adopted in this field. Of course, there have been a considerable number of isolated quarries and stone working plants that have installed diesel engines and are using them with success, but a knowledge of the results of these plants, and I believe it absolutely true to say that by far the great majority of them have been very successful, have not been disseminated throughout the industry.

"Our company has two general types of engines which find use in the pit and quarry field. The first of these is the single cylinder, horizontal engine which is available in 55, 110 and 150 hp. sizes. This engine is of the four-cycle design.

"The field for this engine is primarily as a power unit for belt driven line shafting, pumps, generators, etc., or else as a direct-connected oil engine driven compressor unit. For the small quarry plant, the combination of two or three or any one size of these units usually satisfies the power requirements. Where the capacity requirements go into larger figures, the choice then is usually a multi-cylinder, vertical engine, direct-connected to a generator, in which case the individual power drives are usually from electric motors. In this class we have engines available from 150 to 1,250 hp.

"In analyzing the power consumption around the quarry it will be found that air compressor drive comprises approximately 50 per cent of the total and sometimes even more than this. Due to this condition the direct-connected oil engine driven air compressor should be a machine of outstanding interest to all quarry users. To prove the economics of this statement I quote below two examples in both of which we will assume that the air capacity

A 250-hp. Type PR Ingersoll-Rand engine installed in a New York granite quarry. This quarry has two of these units and two 110-hp. diesel-driven air compressors



Cross-section drawing of Buckeye engine

called for was approximately 500 cu. ft. of actual air.

"First let us consider a steam-driven compressor. In a recent actual proposition of this nature the customer considered a duplex, horizontal steam-driven unit having two single stage, steam cylinders and cross compound air cylinders. The actual free air capacity of this complete machine was 467 cu. ft. per minute. The steam conditions were 100 lb. non-condensing and the steam consumption rate was 38.5 lb. per hp. hour, thus giving a total hourly steam consumption of 3,540 lb.

"Assuming that one pound of coal evaporates 5½ lb. of water and that coal is available at $5 a ton, the hourly coal cost for operating this compressor at full load under the above conditions would be $1.75.

For the electric-driven machines we will assume a cross compound air compressor direct-connected to a synchronous motor having a free air delivery of 568 cu. ft. per minute and a b.hp. requirement of 108. Making proper allowances for motor efficiency, the motor input required to drive this compressor at full load would be 89 kw. The hourly cost of operating this compressor at full load under the above conditions and at varied current rates indicated is shown in the following table:

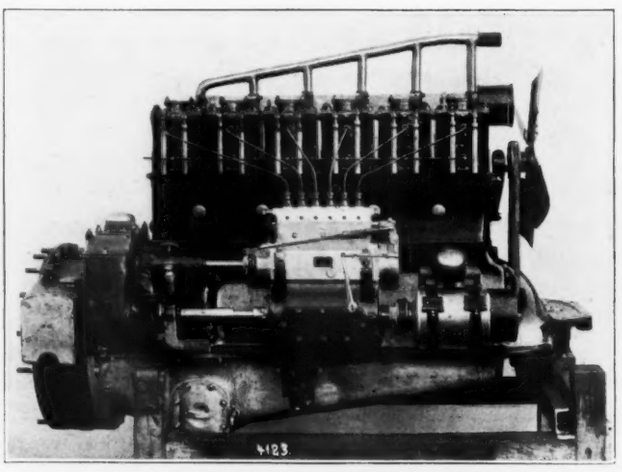
Price per kw. hour	Total cost per hour
1	$0.895
1½	1.35
2	1.79
2½	2.24
3	2.69

"Should we offer a direct-connected oil engine driven compressor unit to handle the job, we would supply our 110 hp. POC-2 compressor unit, which has an actual free air delivery of 500 cu. ft. per minute against 100 lb. discharge pressure. The guaranteed fuel oil consumption is 6.1 gallons per hour. Based on a fuel oil cost of 7c per gallon and a lubricating oil cost of 60c per gallon, the total hourly cost for operating this machine at full load is slightly less than 50c.

"In comparing the performance of the oil engine compressor with that of the steam compressor unit and also that of the electrical driven compressor unit, assuming for the latter that the current cost is 2c per kw. hour, you will note that there is an hourly saving of approximately $1.25 in favor of the oil engine driven unit. This saving is equivalent, of course, to $10 per eight-hour working day or $3,000 for three hundred 8-hour days.

"The savings of the oil engine compressor over either the steam or the electric unit quoted above would pay for the difference in cost in less than a year and a half and would retire the entire cost of the oil engine driven compressor plant in about three years. The figures quoted for current rate and coal cost above, I believe, are fair. The use of 100-lb. non-condensing steam and single stage steam cylinders is one causing high steam consumption rates. The steam consumption figures could be cut practically in half by utilizing higher boiler pressures and operating condensing and with some superheat, but this is not a condition which you find around small sand and quarry plants, for that more than parallels the figures which I quoted.

"I have recently been checking over some 25 quarry and stone working installations where the Type PO engine and engine-driven compressors are in use. The earliest installation was made in 1924, and that unit, at present, is in operation, giving excellent service and has a long expected life ahead of it. These 25 installations are not limited to just one part of the country. If the operators of these plants would permit actual operating figures on their oil engine installations, compared to their costs when using other forms of power, to be spread



Mercedes-Benz diesel, used in auto-trucks

throughout the industry, the oil engine industry as a whole would benefit in increasing its sales and the pit and quarry industries would reduce their costs.

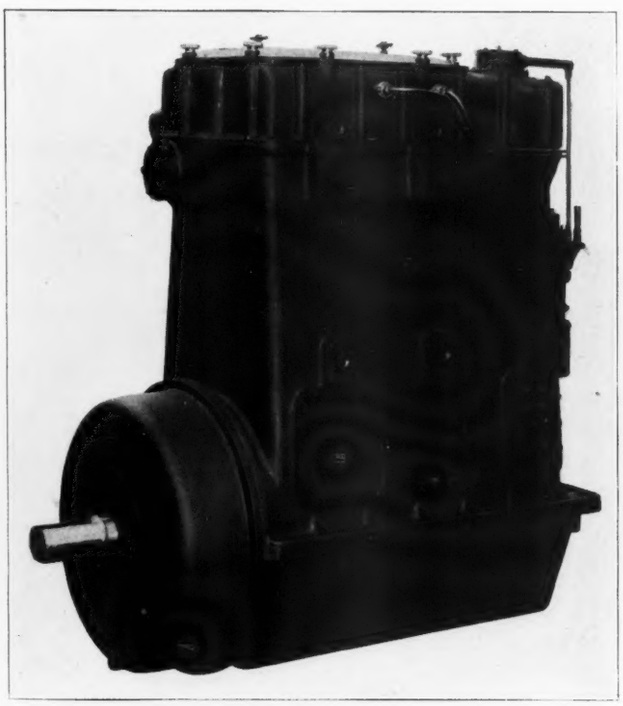
"We have several notable vertical engine generator installations in the quarry field, particularly I might mention the San Antonio Portland Cement plant in Texas, where some 6,500 hp. of engines are installed.

"We are in the same position, undoubtedly, as are all other manufacturers, which is: we believe we can offer an admirable solution to some of the power problems of pit and quarry operators if they will only give us the opportunity to study their conditions and report possible ways of affecting economies for them."

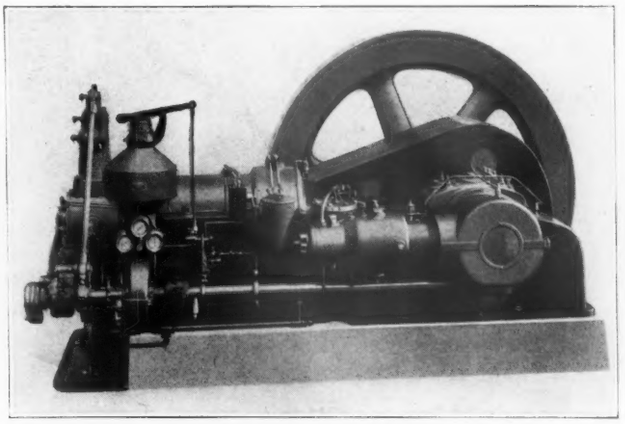
Ingersoll-Rand manufactures a number of types of solid injection diesels and claims these advantages for the PR type: Low fuel consumption; require minimum floor space on account of vertical construction; the fuel is clean, easily handled and readily procurable; it meets the requirements of smoke nuisance ordinances; low cost of attendance; low maintenance cost; low lubricating oil consumption; and no fire risk. Most of these claims apply to oil engines generally and will be implied if not stated in discussing them.

The Muncie Diesel

The Type V, vertical, solid injection, two-cycle diesel oil engines manufactured by the Muncie Oil Engine Company are of the impulse type of solid injection. The manufacturer claims that it permits the simplest design of the fuel handling and governing parts as well as the fuel injection nozzle, and holds that it does not have the hazards as in the systems employing high air pressure or continuous high fuel pressure.



The Fulton-Foos engine



Allis-Chalmers single cylinder oil engine, diesel type

According to the opinion of the manufacturer, it is more convenient to install and operate a vertical engine; it is a low grade fuel user; a two-cycle engine is the simplest in performance of desired functions; a solid injection engine is the simplest of the diesel family type; and the impulse injection type is the simplest of the solid injection types. It requires no dangerous or expensive fuels, no large floor space or foundation, no valves functioning in the combustion region, no scavenging air cylinder, no complicated pump system to supply accumulator, no mechanism operating the fuel valve, and no complicated style of fuel injection pump or nozzle.

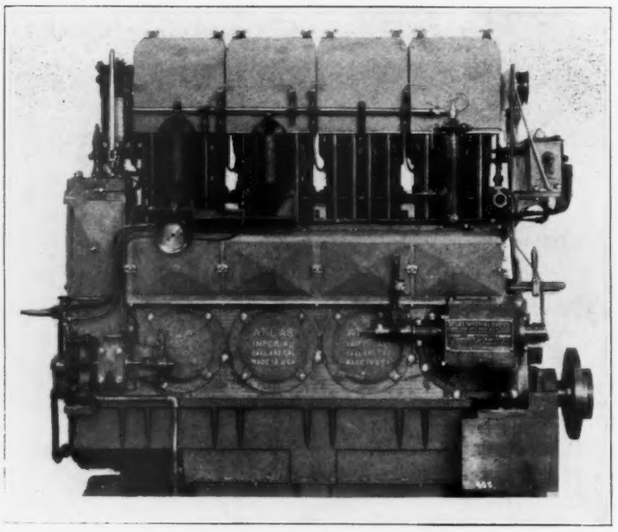
The Hill Diesel

Briefly stated, the characteristics of the Hill diesel engines are: Four-cycle, trunk piston, pump injection, medium to high speed, rugged construction, easy accessibility, forced lubrication, dry sump, low fuel pressure, close regulation shorn of all unnecessary complication, yet retaining all the features required to meet the demands of the most exacting service.

The fuel system is the simplest possible, consisting of a packingless plunger pump with but one moving valve, yet performing all the necessary functions such as measuring the fuel to the finest degree, delivering it to the nozzle, instantly relieving the pressure at the right instant, and returning the surplus to the reservoir.

The spray valve is particularly rugged and free from fine orifice. Never clogs or requires cleaning from the results of poor combustion. It delivers the fuel in proper condition to a large precombustion chamber in the cylinder head where ignition occurs from the heat of compression, and the resulting gas is injected into the cylinder with force through a large hole, creating great turbulence, completing combustion to a smokeless exhaust.

The general design conforms to the latest ac-



Atlas-Imperial engine, used to power Bucyrus excavators

cepted engineering practice, including complete enclosure, large bearings quickly accessible, alloy castings and steels.

Hill diesel engines are built in both marine propulsion and stationary models, the latter being well adapted for auxiliary service driving generators, compressors, pumps, and other machinery in pits and quarries. Many compact combined units have been built for motor ships, yachts, and stationary power plants.

The Buckeye Diesel

The Buckeye vertical diesel is a four-cycle engine of the air injection type. The principle of ignition is the burning of fuel by heat of compression as the engine will start instantly on the lowest grade of commercial fuel.

The oil is injected under pressure directly into the cylinder combustion space which is of plain design and free from all pre-combustion chambers or restricted openings. Air is admitted into the cylinder by a patented cylinder-heat feature. This new principle of admitting the air assures a thorough admixture of oil for proper combustion.

The seven exclusive features claimed for the Buckeye engine are: Air turbulence producing complete combustion, full pressure lubrication, cylinder heads removable without disturbing manifolds or piping, inbuilt air filter, inbuilt lubricating oil filter, inbuilt fuel oil filter, and all parts fully enclosed.

Allis-Chalmers Diesel

The Allis-Chalmers diesel is of the air injection and horizontal type. Air is furnished by a multistage compressor mounted on the main frame and driven directly from a crank on the end of the main shaft. It is water-jacketed and the same casting contains a separate compartment with coils for inter-cooling the air. The compressor delivers the injection air direct to the nozzle without the use of high pressure bottles, which are avoided by making the starting air and injection air systems entirely independent. The open fuel injection is claimed to be a most important advance toward continuity of service and adaptability for various oils that has been made in the diesel type of engine. It consists of an oil receptacle with separate inlets for the oil and air at one end and connected to the combustion chamber at the other end by a stationary atomizing device. The oil is pumped into the receptacle through check valves during the suction stroke of the engine and the injection air is admitted through a separate, mechanically operated timing valve. There is no valve after the oil and air are mixed and no perforated or notched discs with restricted areas and sharp changes in direction. Allis-Chalmers makes a specialty of combined engine and generator sets, designed and built as complete units.

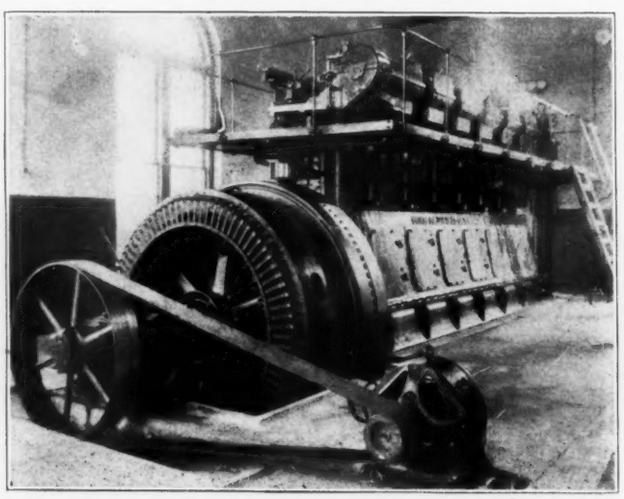
The Atlas-Imperial Diesel

These engines are of the four-cycle, mechanical or solid injection type, claimed to retain all of the advantages of the air injection type, without its complications; no high pressure blast air is used in the fuel injection.

Ignition and combustion without explosion is accomplished by means of the heat of compression. Air is drawn into the cylinder and is compressed by the upward travel of the piston to a pressure of approximately 380 lb. per square inch, heating the air to a temperature of 900 degrees Fahrenheit. A few degrees before the piston reaches the top of the compression stroke, the fuel spray valve is opened and the fuel is sprayed into the heated compressed air which ignites the fuel. The rate at which the fuel is injected into the cylinder is so graduated that its ignition takes place without explosive violence.

Efficiency Guarantee

The consumption of diesel fuel oil having a mean



Busch-Sulzer 600-hp. engine, installed in 1925 in the plant of the Coronet Phosphate Co.

low heat value of not less than 18,500 B.t.u. per lb. and sufficiently liquid at normal temperature or when pre-heated to flow freely to and be handled properly by the fuel pumps, is guaranteed not to exceed the following quantities at or near sea level, to-wit:

At full load: 0.45 lb. per b.hp. hr., or 6 gal. per 100 b.hp. hr.

At ¾ load: 0.47 lb. per b.hp. hr., or 6/5 gal. per 100 b.hp. hr.

At ½ load: 0.53 lb. per b.hp. hr., or 7 gal. per 100 b.hp. hr.

The fuel oil may be either paraffin or asphaltum base, with a flash point not less than 150 degrees Fahrenheit, free from solid and non-combustible matter, with not more than a trace of acid, nor more than .01 per cent of ash, .5 per cent of water, 1.5 per cent of sulphur or .05 per cent residue. Regular 24 degrees Be. diesel fuel oil is recommended for best results.

Guarantee for Electric Generator Sets

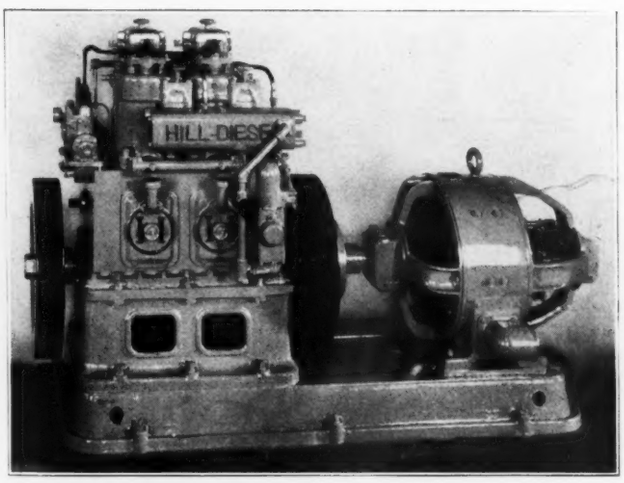
Assuming 90 per cent over-all generator and exciter efficiency, the guaranteed fuel consumption at full load is equal to approximately 10 gal. per 100 kw. hr., or about 1/10 gal. per kw. hr. on the switchboard. The actual fuel consumption after the first few months of service is usually about 10 per cent less than the guarantee.

The Superior-Otto Engine

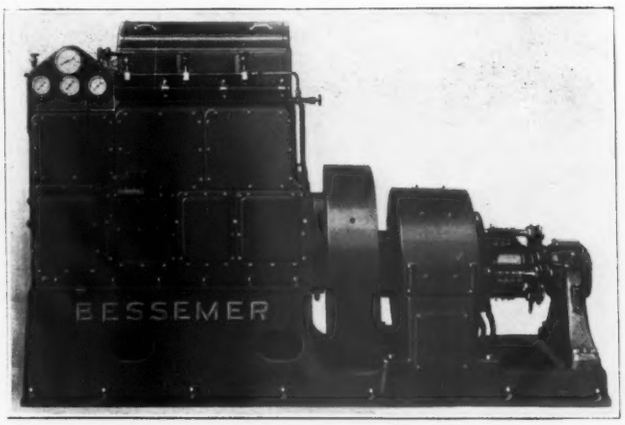
This engine is of the four-cycle, airless injection, cold starting vertical type, built in sizes for 60 to 300 hp., with one, two, three, four or six cylinders. Being of the slow speed stationary type, built for heavy duty and continuous service over long periods, it is claimed to insure low fuel and lubrication costs with minimum attendance and repairs. Fuel consumption averages less than 0.40 lb. per b.hp. hr. from half to full load.

Buda-M.A.N. Diesel

The Buda-M. A. N. diesel engine represents some



Hill engine direct conneted to a G. E. generator



A Bessemer engine

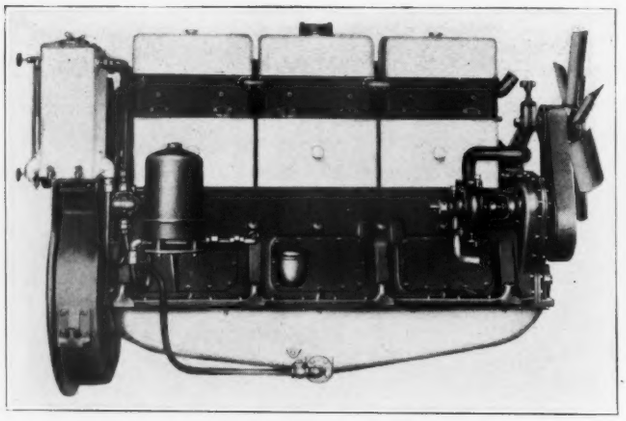
of the latest development in light-weight high-speed diesel engines for industrial and marine service, and is manufactured under license from the Maschinenfabrik Augsburg-Nurnberg A. G. of Germany, commonly known as the M.A.N. Company, in whose shops Dr. Rudolph C. Diesel built his first engine in 1897.

Through the affiliation with the M.A.N. Company of Germany, the Buda-M.A.N. diesel engine has the benefit of two efficient organizations. The M.A.N. Company is fully conversant regarding every detail of diesel construction as well as new developments, and offers The Buda Company and users of Buda-M.A.N. diesels the benefit of all improvements and developments and the fullest cooperation at all times.

It is of the four-stroke-cycle principle, airless, or solid fuel injection, forced feed lubrication and self-starting. It is designed so that the fuel is injected into the combustion chamber by means of pressure from the fuel pumps, and without the use of compressed air or pre-combustion chambers. This system makes it possible to start a cold engine in a short time and without any special preparation. In this connection, simplicity of operation is introduced by constructing all fuel injection valves of the open nozzle type, thus dispensing with check valves and other movable parts. A specially designed filter is assembled as part of the engine for filtering the fuel oil.

The fuel pumps are arranged to meter fuel in proportion to the speed and power required. The pumps are connected with the governor, and control the duration of fuel injection according to a specific crank angle proportionate to the speed and load. This produces about the same effect as the butterfly valve in a carburetor. The fuel pumps are arranged so that injection may be advanced or retarded according to speed. A safety governor prevents over-speeding beyond the maximum, and provision is made for manual as well as governor regulation.

This engine is designed in different sizes to meet the demands of industry. It is now operating



Buda-M.A.N. 6-cylinder, 180-hp. solid injection engine

shovels, cranes, compressors, locomotives, dredges, pumps, crushers, electric generators and almost all other classes of machinery common to the pit and quarry industries.

Bessemer Stationary Engines

The Bessemer diesel engine is of the four-cycle, solid injection, vertical type, built in units of from 40 to 1,240 hp. The diesel principle is the ignition of fuel by the heat of compression. By compression, the temperature of the air in the cylinder is raised to approximately 900 degrees Fahrenheit which is sufficient to ignite the fuel oil when properly sprayed into the compression chamber. The oil spray burns at this temperature, increasing the cylinder content, or the molecules of hydrogen and carbon of the oil unite with the molecules of oxygen in the hot compresesd air, forming H_2O, CO and CO_2.

Starting is accomplished by the aid of compressed air with an air pressure of from 200 to 250 lb. per sq. in. The air pressure required depends upon the load the engine is carrying at the time of starting. The air tanks and the entire compressed air system is built and tested out for a working pressure of 250 lb. per sq. in. in order to carry a large reserve for unusual conditions should occasion ever require. Air is admitted on every power stroke of the piston and the entire air starting valve mechanism is automatically swung out of action after the engine is in motion. This allows the engine to be started on the minimum quantity and pressure of air. This permits the starting of the engine from stone cold to full power without the use of high pressure air, and consequently eliminates a three-stage air compressor, and the air receivers and intercoolers necessary for the use of high pressure air.

McIntosh & Seymour Diesel

In reply to our enquiry, R. C. Paul of the McIntosh & Seymour Corporation writes as follows:

"The best example of an installation of one of our engines in this industry is at Moline, Kansas, where the Solvay Process Company has installed one of our 400 hp. engines. This engine drives an a.c. generator and supplies the quarry with power.

"We are enclosing a copy of photograph which shows this engine installed at the power house, at Moline. You will note that it is a four cylinder engine. It operates at 200 r.p.m. This is one of our standard air injection engines.

"This unit burns fuel oil, a product which is easy to procure in this locality at a reasonable cost and, in-as-much as the fuel consumption is low, the cost of fuel is very low. Also because of the small amount of attendance required, the labor item is a small item.

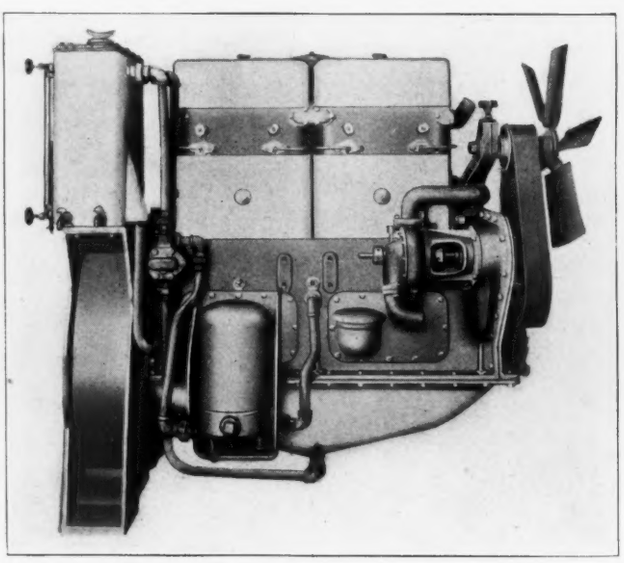
"Another feature which makes this unit well adapted to quarry operations is the small amount of cooling water required. In general, a diesel engine requires as much water for cooling as an equivalent size of steam engine would require for feed water and often times can make use of water that would not be at all adapted to feed water purposes. By the simple expedient of using a cooling tower or cooling pond, the water may be used over and over again.

"The reliability of a diesel engine also makes it well adapted to quarry operations. The engine is able to make long uninterrupted runs when called on.

"In general the features of the diesel engines which make it well adapted to quarry operations are low operating costs, reliability, ease of handling fuel, small amount of cooling water required, and ability to readily change its location as the quarry operations may demand. This last feature is possible because the unit is self-contained and when it is moved from place to place only a relatively small amount of new piping is required."

Fairbanks-Morse Stationary Engine

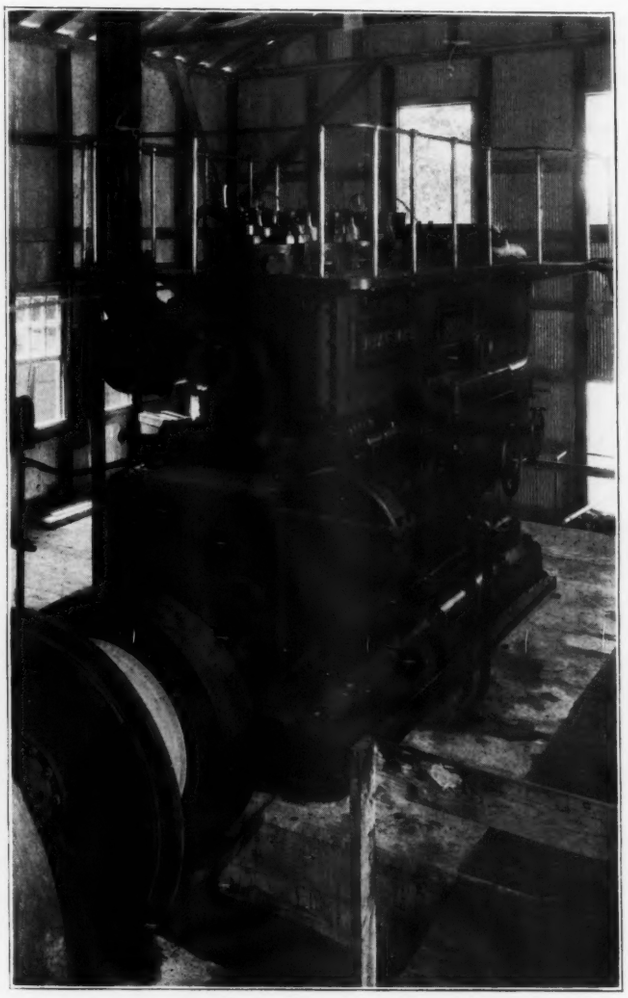
The two-stroke cycle principle as applied to the



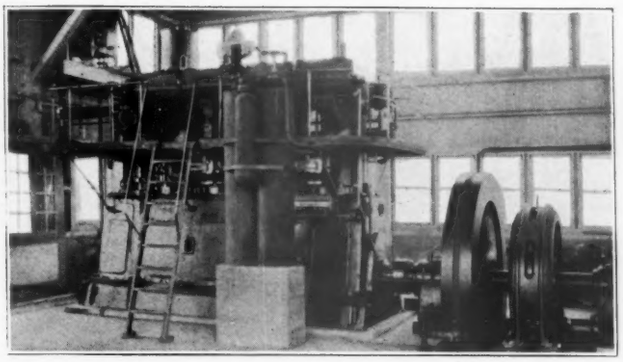
Buda-M.A.N. engine, used to operate P & H shovels

diesel engine results in extraordinary mechanical simplicity with a minimum of adjustments and operating attention. By the same token the entire elimination of all intake, exhaust and scavenging valves with their necessary multiplicity of rocker arms, push rods, lay shafts, eccentrics and timing gears results in a simplicity of construction that is worthy of note. This type of engine is typically exemplified by the Fairbanks-Morse 560-hp. 4 cyl. diesel shown in the accompanying illustration as installed in the plant of the Sunbeam Quarries at Clermont, Ky. Aside from the fuel injection and governing mechanism and on the larger size units, the built in scavenging air pumps, the only moving parts are the power transmitting elements; the piston, rods and crankshaft.

This engine is of the airless injection type, a principle of operation which still further enhances simplicity in construction. Both air inlet and exhaust ports are located in the cylinder wall in a position to be uncovered by the piston near the bottom of the stroke. Consider the cycle as beginning with the upstroke with a charge of fresh air in the cylinder. The piston first covers the intake part and immediately afterward, the exhaust part.



Fairbanks-Morse engine furnishing power for Sunbeam Quarries, Clermont, Ky.



A McIntosh & Seymour 400-hp. engine, driving an a.c. generator at plants of the Solvay Process Co., Moline, Kan.

Compression begins and is carried to approximately 500 lb. per sq. in.

As the piston reaches top center fuel is injected and burning takes place as the piston starts its power stroke. After burning, expansion takes place completing the downward stroke. Near the bottom of the stroke the piston uncovers the exhaust port and the expanded gases leave the cylinder reducing the pressure to atmospheric. Shortly after exhaust begins the piston opens the scavenging port and fresh air under a pressure of about 2½ lb. per sq. in. rushes in thus completing the cycle. In the smaller sized engines the scavenging air is compressed in the crankcase; in the larger, by a built-in scavenging pump as illustrated.

Main bearings on the smaller units are ring oiled while on the larger continuous pressure lubrication is provided for all crankshaft and piston pin bearings. Pistons are lubricated by a mechanical force feed lubricator which is supplied by the pressure system. In the larger units piston cooling is effected by the circulation of oil through the piston head, in the smaller, piston contact with the cylinder wall provides ample cooling.

Speed is controlled by means of a completely inclosed yet easily accessible fly-ball governor which acts on the suction valve of the fuel injection pump to regulate the quantity going to the cylinder. In addition an automatic overspeed stop is provided which shuts off the fuel entirely in case the governor should fail to function. The starting lever and manual control is located on the side of the engine for easy accessibility as shown. Arrangements may also be easily made for remote control.

The De La Vergne Engine

This engine is of the four-cycle, solid injection, vertical type and is the result of more than 40 years' experience in the building of prime movers. This engine, using a petroleum oil having an effective heat value of 18,500 B.t.u. per lb., has a guaranteed fuel oil consumption as follows:

Full load: 0.45 lb. per b.hp. hr.
¾ load: 0.45 lb. per b.hp. hr.
½ load: 0.50 lb. per b.hp. hr.

Two 130-hp. DeLaVergnes, belted to drive machinery

These guarantees are conservative, include no tolerance allowance or contingent qualifications, and are roughly 10 per cent above actual consumptions. Actual fuel consumption is a measure of the approach toward perfect combustion. Between 50 and 100 per cent of engine rating, this curve is fairly flat and continues nearly flat for about 15 per cent above full load, showing that the engine is conservatively rated.

The Union Diesel

This machine is of the four-cycle heavy-duty, solid injection type with valves in the head, force feed lubrication and enclosed crank case. Ignition is accomplished by heat of compression. The fuel is thoroughly atomized as it enters the combustion chamber, without the use of compressed air. This results in ease of starting, complete combustion and clear exhaust. Fuel is presented to the compression heated air in a finely divided state so that the maximum surface of fuel comes in contact with the maximum surface of oxygen. Solid fuel is pumped into the fuel valve body by the fuel pump at a pressure of from 3,000 to 3,500 lb. per sq. in. At the time desired for fuel ignition, the fuel stored at high pressure is forced through small orifices into the combustion space, where the pressure is approximately 400 lb. per sq. in. This difference in pressure results in high velocity flow through the orifices which breaks down the surface tension of the liquid fuel and causes it to enter the cylinder in the form of vapor.

The Anderson Engine

The Anderson Type KD heavy-duty engine is of the two-cycle, cold starting, mechanical injection, vertical type. Every upward movement of the piston draws the crankcase full of air, which is compressed by the downward stroke until the inlet port is uncovered by the piston when this compressed air is transferred from the crankcase to the cylinder on the two-cycle principle.

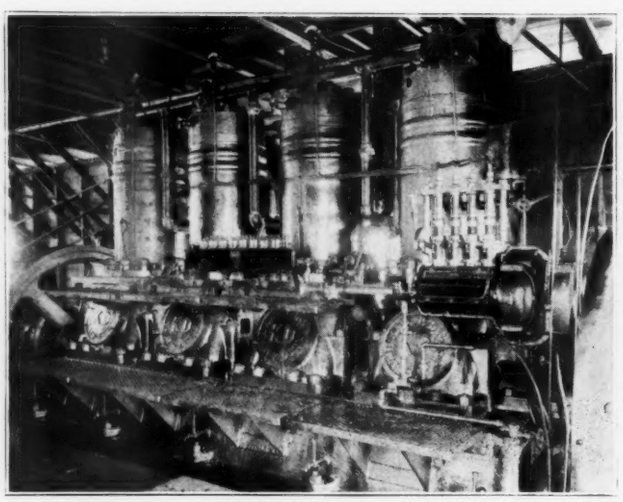
This engine is designed to fill practically every stationary power need, by any means of transmission. It is claimed to be of high efficiency and exceptional strength, with slow moving parts and sufficient safety factors. It is as automatic as an engine can be built, sufficiently simple for the average user, can be lubricated economically, operates steadily without massive foundations, works well in hot or cold climates and burns any fuel used by engines of this type. To insure long life, the parts on this engine operate slowly. Piston speeds are well within the limits of standard practice and careful engineering.

Page Diesel Engines

As pointed out by its engineer, for many years the Page Engineering Company, manufacturers of excavating machinery, has been buying internal combustion engines of many varied types from a number of prominent engine builders in this country, using these engines on dragline excavators. Dragline excavators, as it is well known, are used extensively in the pit and quarry industries.

A few years ago the Page Engineering Company started to build engines, and since that time, every one of the Page machines has been equipped with the Page diesel. Due to the severe load conditions existing on dragline excavators, the engine had to be built especially rugged and substantial. It was decided to build an engine that had but two cylinders and of horizontal construction, of the four-cycle type with cranks offset 180 degrees. To enable the engine to take care of shock loads and overload, a pair of extra heavy fly wheels have been provided.

The fuel is injected by the gas injection system. The oil is fed to the fuel valve by gravity from a small fuel oil chamber pump, forming an integral part of the fuel valve. The Page engine has few small parts, and those are usually made of cast steel in order that they might not be broken or damaged easily. The crank shafts have been given very liberal dimensions; the bearings are large all



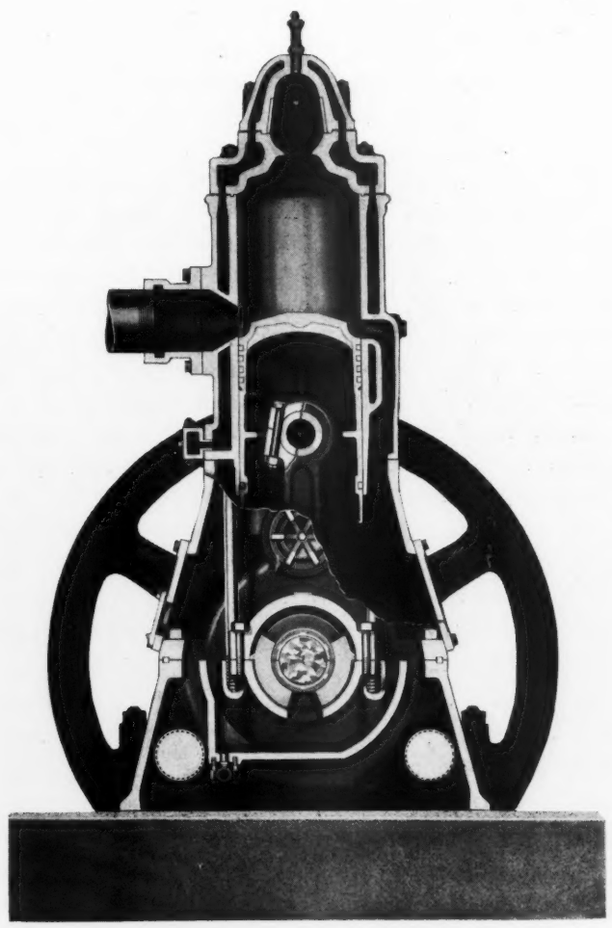
Anderson Type KD heavy-duty engine

the way through. On the larger engine force feed lubrication has been adopted and oil is positively fed to each important bearing. On the smaller engine the lubricating oil is being constantly circulated through the bearings and all the oil is passed through a filter. The engines are water cooled, the water being circulated by means of a positive plunger pump. A large radiator is connected to the water system to cool the water after it comes from the engine.

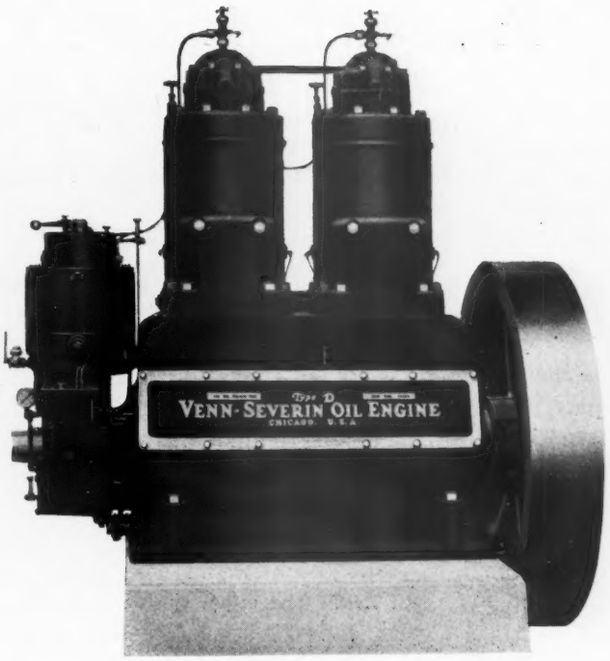
This engine has been designed especially for heavy-duty dragline work, a great many of them driving draglines 24 hours a day for several weeks. They are also being used for driving rock crushers and similar machinery.

At present two sizes of cylinders are in production: The smaller one has a bore of 10½ in. and a stroke of 15 in., and normally runs at a speed of 350 r.p.m. The larger engine runs at a speed of 250 r.p.m., and has a bore and stroke of 13 in. and 20 in. respectively.

The fuel consumption of these engines is exceedingly low, running well below .5 of a pint per horse power hour. Practically any free flowing oil of say 28 degrees Be. or better is recommended in these engines for best over-all results. No special ignition device of any kind is used in this engine as it is of the strictly high compression diesel engine class. Also on account of it being of the gas injection type, no high pressure air compressor is necessary.



Cross-section of the Venn-Severin



Engine in operation

The Venn-Severin Oil Engine

This is not a true diesel, as defined by oil engine engineers, as it is started by a small electric heater built by the manufacturer. The builder claims that this system is more dependable than starting by means of compression only, as in the high compression engine. It is a two-cycle engine, each cylinder receiving its power impulse every revolution instead of each alternate revolution. Its simplicity eliminates all troublesome valves, camshafts, push rods and adjustments.

The piston, during its up-stroke, compresses pure air in the cylinder. At the same time, it acts as a suction pump on the crankcase, drawing fresh air through the air cleaners in the lower base. The air is sucked up around the enclosed main bearings and is drawn into the crankcase through the two multiple-disc air-intake valves. When the piston completes the up-stroke, combustion occurs, driving the piston down on its power stroke. At the same time, the air is slightly compressed in the crankcase. As the piston approaches the end of the stroke, it uncovers the exhaust ports at the rear of the cylinder, allowing the pressure to escape, and the scavenging ports of the front of the cylinder uncover.

A second installment of this article will appear in an early issue of PIT AND QUARRY. It will be mostly concerned with a discussion of the present uses of diesel engines and their future possibilities.

Practical Experience Versus Academic Training Among Plant Foremen

Subordinates Should Be Taught How to Lessen Operating Costs

By D. F. NOLL

NOT long ago a prominent writer on mining engineering subjects commented on the frequency with which he found men, who could neither read nor write, in charge of large pit and quarry operations; and he urged on all quarry owners the importance of employing foremen who not only knew their A B C's, but had mastered also the rudiments of engineering and accounting.

Successful production engineers are agreed that the foreman, or plant executive, or boss, or whatever you may call him—the man who comes into direct contact with the machines, the materials, and the workers—is the one who either makes or mars.

In several years contact with gravel pits and stone quarries, the writer has seen many efficient plants competently handled by men whose academic training was very slight. From time to time he has observed the management of quarry operations turned over to well educated young men who had persuaded the owners of their ability to save sick businesses. For a time these enthusiastic young men with leather puttees and Stetson hats bustled around tacking up notices, drawing charts, and issuing orders. Eventually, however, the "old-timer" came back into control of operations. The younger man got into "hot-water" of one kind or another, and left for greener and fairer fields of endeavor. Often the practical man who had learned the quarry business in the University of Hard Knocks had too great an advantage over the technically educated man. While one was mastering logarithms and lettering, the other was learning to operate and repair shovels, crushers, and conveyors, and accumulating a fund of first-hand knowledge of quarry operation.

That the old-timer has a background of practical experience enabling him to solve and overcome the daily routine problems of his job is no discredit to the technically trained man who has not had the advantage of long years of apprenticeship. It takes years of familiarity with quarry practice to overcome the daily routine of perplexing problems. Nor can we expect men with the earning capacity of trained engineers to spend even a small fraction of the time in the apprenticeship the old-timer has served as water-boy, shovel-runner, or kiln operator. It is easier to supply the practical man with what he needs than to make old-timers out of trained engineers.

The practical man makes many decisions by instinct, frequently without knowing why; and, although by rule of thumb, these decisions are often superior to the more scientific methods of the trained industrial engineer. But the practical man who thinks all he needs are the lessons of his own experience is neglecting valuable opportunities for development and improvement.

The advantages that the trained engineer possesses lie in his broader knowledge of general engineering, in the better perspective at which he sees his problems, and in his ability to adapt to his own operation management methods that have succeeded elsewhere. The practical man's lack of general engineering knowledge is usually more than compensated by his specific and detailed acquaintance with the mechanics of his shovels, crushers, and conveyors. The problem is to develop the perspective of even the humblest foreman and to teach him to manage his department in a way to that followed by his higher executives in managing the business as a whole.

Executives have long recognized this possibility for improvement. The foreman is promoted from the ranks for superior individual productivity. He comes to regard this recognition of his ability with considerable self-satisfaction and, unless his superiors are very careful, he views the promotion as a stopping stone rather than a stepping stone. Operating a shovel is quite another thing from getting maximum yardage from half a dozen shovels operated by others; although the practical man who has actually operated one has more chance than the engineer who knows the tensile strength of the hog-rods but is without real operating experience.

The purpose of this article is to describe a few methods that the writer has used with success in winning and maintaining the interest of foremen and in developing their ability to manage. The results obtained have been gratifying. Foremen were found to possess latent ability in effecting economies the possibility of which had never been suspected. In cases of some foremen who were assumed to be little concerned over costs, it was found that no effective mechanism existed for letting them know what their costs were; and the burden of cost-reducing was then transferred from an executive at a glass-topped desk to a score of

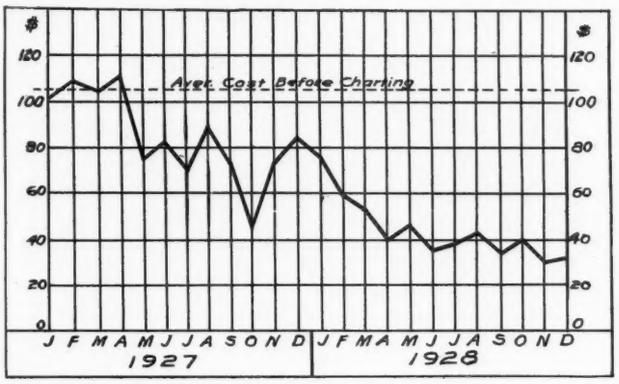


Chart I

men around the plant in the closest possible contact with operations.

Lest the reader suspect that the writer may be drawing dangerous generalizations from his own limited experience, we may say that the president of a company that has had a phenomenal growth in the building materials industry in recent years attributes his company's success to similar methods. Essentially the plan is to furnish the foreman with enough information regarding his department to give him a broad perspective for capable and timely decisions. This information will be in several forms,—cost figures, production records, and reports showing the time of machines lost by delays, with their causes.

The limitations of this article prohibit going into detail. Only the barest outline of the plan can be indicated. The desired information in the average plant is available and assembled daily, but is rarely used to the greatest advantage.

The writer recalls an early experience where the Daily Operating Report was the superintendent's bugaboo. If it did not reach the general offices at a given time each day, trouble ensued. It was really a well-designed report, but its function was completely eclipsed. Once it reached the general offices, it was filed and never heard of again. What the superintendent regarded as a daily chore might have been made a valuable aid to his management. The additional cost of presenting the data in really helpful form would have been negligible. In fact, wherever the cost of preparing and presenting adequate information is deemed prohibitive, the truth usually is that the executives themselves have not had experiences demonstrating its utility and value.

One of the most effective means of stimulating the foreman's interest is to acquaint him with records of his department as shown by the cost accounts already being kept. Practical men are frequently criticized for striving for a large volume of production regardless of cost. They seem little concerned over costs, and consider them only as a problem for those higher up in the management. It is only natural that such men disregard cost figures which have never been translated from the jargon of the accountant into terms they can understand.

When the accountant thinks only in terms of journal entries, trial balances, and controlling accounts; when his system is so involved in details that even the higher executives have difficulty in extricating anything of value to them in the management of their business; or when an accounting system that is adequate for bookkeeping purposes has gaps in the available information that destroy its usefulness so far as a production executive is concerned; it it small wonder that the foreman forgets about costs.

To be of interest and service to foremen, cost data must be analyzed and comparisons must be made with previous periods and with the volume of production. This means careful selection of the form in which the data are to be presented—a job for the best talent in the organization. The costs should be divided into accounts that coincide with the field of the foreman's authority and responsibility.

The forman is likely to resent the intrusion of the accountant into what he considers his own affair. He will question the accuracy of the figures. He will conjure up numberless objections. But when he finds that his accomplishments are going to be measured by a definite plan, he will soon take an interest and he will be eager to make a good showing by the plan. To win and maintain a foreman's interest and active support in the collection and use of cost data, the foreman must see that the data enable himself and others to measure his performance and progress.

The best means of translating accounting facts so that the foreman can understand and use them to advantage in managing his operation is through the use of charts. An old Chinese proverb says that a picture is worth ten thousand words, and even the most unlettered foreman can understand Chart I.

The procedure presented in Chart I is neither complex nor strikingly novel. But the resulting

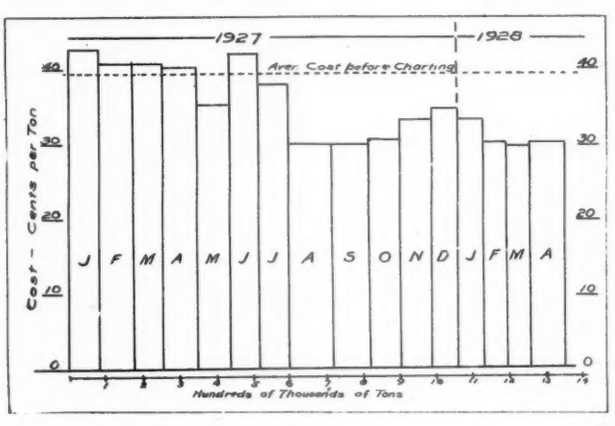


Chart II

decrease of costs illustrates a very important principle: that, when a foreman's attention is called to any particular item of expense in a way that makes a real impression on his memory, he watches that item of expense more jealously. If his attention be called repeatedly every month, he not only tries to better his previous record, but he gets impatient with slower progress and seeks to improve it by more drastic reductions.

The curve in Chart I represents an actual example in the writer's experience. The cost of belting had been included in the cost of all supplies issued to a single department for each month. Belting was a relatively minor item representing about 10 per cent of the cost of all supplies. For the accountant's purposes, it hardly seemed worth the expense of classifying the aggregate of all supplies into its component parts. "Saving money for the company" was a very good motto; but, although the foreman had from time to time been called "on the carpet" about costs of his supplies "in the large," no progress was made until a classification of the items of Supplies suggested points of attack.

In this chart, the figures for the first few months indicate the higher consumption of belting that had prevailed before the foreman's attention was attracted by the more detailed analysis of costs. For some months a lower level was maintained and then, after thorough testing, another type of belt was adopted and a saving of approximately two-thirds of the original figures was effected.

More examples of what was accomplished in reducing the cost of other supplies might be given, although, in every instance, distinct and measurable progress was made.

Chart II is another example from the writer's experience, with no reason apparent for its success other than that the chart focused the foreman's attention on a record that he endeavored to better. This chart is unusual in that it combines three elements; cost per unit on the vertical scale, volume of output and time on the horizontal scale. The horizontal distance allotted to each month varies in proportion to output. The area represents graphically the relative expense for each month.

This chart is suggested in preference to the usual form of production graph because it emphasizes cost per ton. Although the volume of production is given its due importance, the foreman is taught to think in terms of cost per ton whether sales are slack or booming.

In this article we have confined our emphasis to the possibilities for economies when the practical operator has the fullest cooperation of his management. The examples have been of the simplest sort.

Eighth National Power Show Expected to Exceed Predecessors

Plans are well under way for the eighth National Exposition of Power and Mechanical Engineering at Grand Central Palace, New York City, opening December 2 and continuing throughout the week. The National Power Show, as the exposition has come to be more briefly known, has become a national institution since its inception in 1922 when the attendance was only 47,589. Last year's attendance had risen to 123,000 and the number of exhibitors had made the phenominal showing of 542 in 1928 as against only 105 in the first year of the exposition. This growth, it is pointed out, is due largely to the fact that the exposition covers the entire field of power generation and mechanical engineering.

Another important factor entering into the remarkable growth of the National Power Show can be traced to new developments in the field. Never in the history of science has there been such rapid and exceptional advancement in mechanical engineering equipment as during the years the exposition has been functioning. There have been more inventions and more improvements in these few years than ever before and it is these improvements and inventions which will furnish stimulus and zest in the competitive reciprocity between producer and consumer at the exposition.

Canadian Cement Industry Boosted By Road-Building Plans

With the road-work plans contemplated throughout the Canadian West, together with the new construction planned in the country, the Canadian cement industry must be prepared to supply approximately $100,000,000 worth of material within the next two years or so. It is suggested that, even with the western plants working at capacity, this business can hardly be taken care of, and some of it will undoubtedly find its way east or new factories will have to be hurriedly erected.

Manitoba, Alberta and Saskatchewan governments all have extensive road-building plans. Manitoba has large quantities of gravel available, but the cost of maintaining these roads, based upon Manitoba's experience and information from Ontario and the United States, is higher than the cost level of cement roads. As a result, many municipalities in the west are urging the use of cement as a substitute for gravel and the Union of Municipalities is discussing the subject seriously.

Cement is declared to cost from three to four times more as the initial material, but repairs are much less in cement highways, which stand heavy traffic so much better than gravel highways that experts insist that the use of cement is more economical.

Two Pioneers in the Concrete Central Mixing Field

COMPARED to some of the other pit and quarry industries the commercial concrete central mixing plant is an infant but a rapidly growing one. The first plant of this type was built less than ten years ago yet there are now over a hundred in operation with many more under construction. Two of the older plants which are yet in operation are described in this article. One is the plant of Jahncke Service, Incorporated, at New Orleans, La., and the other that of the Central Concrete Company at Indianapolis, Ind.

Jahncke Service, Inc.

The central mixing plant of Jahncke Service, Incorporated, New Orleans, Louisiana, the largest producers of sand and gravel in the Gulf states, went into operation in February, 1927. It is located at the main yards of the company at Claiborne street and the New Basin. The plant has a capacity of 180 cu. yd. of concrete per day.

Sand and gravel from the storage piles in the material yard are handled into wooden bins, with a total capacity of 110 tons, at the top of the plant by a Brownhoist pier crane handling a 1¼-clamshell bucket. This crane is electrically operated and derives its power from a third rail. It is also used to load materials from the stockpiles into various truck-loading bins.

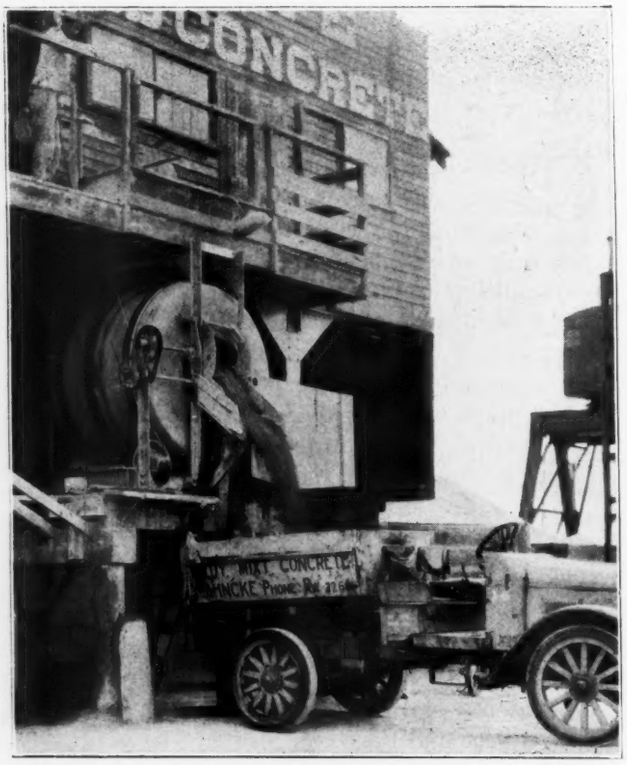
The sand and gravel feed from the bins into two

Weighing Batchers at Jahncke Service Plant

Blaw-Knox volume batchers which are calibrated in cubic feet for any mix desired. The batchers discharge into a Ransome steel hopper where the cement is added. This hopper discharges through a gate into the Ransome 1-yd. mixer which is driven by a direct-connected 40-hp. Westinghouse motor. This system allows three batches of different mixes, as desired, to be in preparation at the same time, one in the batchers, one in the hopper and one in the mixer, without any delay in operation. Water is automatically measured in a

Traveling Crane at Jahncke Service Plant Loading Sand from Stockpiles into Hoppers

Truck About to be Loaded at Jahncke Service Plant



Jahncke Service Mixer Dumping Batch Into Truck

Ransome 40-gal. capacity water tank. A Blaw-Knox steel framework on concrete foundations supports the hoppers, bins and mixer and forms the major part of the building. The foundations are supported on piling due to the marshy ground.

Cement is shipped in on a side-track and unloaded directly into the plant. The second floor of the building, where the batchers are located, is always filled first and the excess stored on the first floor. A Jeffrey bag elevator driven by a 2½-hp. motor handles the sacks.

The concrete is delivered in regular 1½-ton steel bodied dump trucks which successfully haul from 4 to 5 miles. Two men can keep the plant operating at capacity and during slack periods one man can turn out 100 cu. yd. of concrete per day. The arrangement is such that a man on the mixer platform can control and watch all operations.

The sand and gravel for the plant and for distribution is shipped in by rail from plants operated by the company at Roseland, Louisiana, and Brookhaven, Mississippi. Dredges are also operated for oyster and clamshells in various lakes near New Orleans, for lake sand in the Rigolets outlet to Lake Pontchartrain and the Pearl river in Mississippi. These materials are hauled to the New Orleans yards in barges.

The Central Concrete Company

The central mixing plant of the Central Concrete Company is located at 21 and Montcalm streets, Indianapolis, about 2½ miles northwest of the heart of the city and in a rapidly developing section. This plant went into operation in the spring of 1925 at which time there were less than ten plants in existence. It has a capacity of over 100 cu. yd. of concrete per day.

Sand and gravel are purchased from nearby plants, of which there are a number, and hauled in trucks. These discharge into a concrete pit at the plant. A belt bucket elevator with Jeffrey buckets discharges the material into a chute at the top of the plant which has a gate allowing loading into either of the two bins. Both are of wood, metal lined, and have capacities of 100 and 50 cu. yd. respectively for gravel and sand.

The bins discharge into two Butler volume batchers which in turn discharge into the 1-yd. Smith mixer. Water is supplied from a water-measuring tank of own design. The mixer is direct-gear driven by a Wagner 25-hp. motor and the elevator by a 10-hp. General Electric motor.

Cement is received in carload lots on a siding from which the sacks are unloaded into a brick storehouse adjoining the plant. The cement sacks are emptied as needed into a bin feeding a belt bucket elevator which discharges into a chute hopper over the mixer. A special trapdoor arrangement allows a measured amount of cement to be added to the mix.

Two United trucks, with 1½-yd. steel-dump bodies and pneumatic tires, are owned by the com-

(*Continued on page* 86)

How Europe Fosters Its Cement Industries

By FRANCIS MILTOUN

THE world output of cement has increased 78.5 per cent since 1913. Divisionary production, based upon information compiled by the economic section of the League of Nations (July 1929), shows the following changes in the relative volume of output of the various producing regions.

	1913 Per cent	1928 Per cent
Europe	52	45.2
North America	44	45
South America	0.1	0.8
Asia	3.1	7.1
Africa	0.4	0.6
Oceania	0.4	1.3

Since 1913 various countries have come into production:

	Metric Tons
Cuba	272,000
Ecuador	12,000
Peru	76,500
Venezuela	13,600
Morocco	6,800
Mozambique	20,400

Even Uruguay, the Sudan and Siam have established new industries and Holland's cement industry owes its inception, and partial freedom from import from foreign sources, to the recently established plant at Maestrich.

Competition in world markets is becoming keener than ever. Fixed charges, quite apart from the volume of output, weigh heavily on all producers whose plants are virtually obliged to run to full capacity in order to bring down prices to the competitive scale called for by a world-wide strenuous selling campaign of the various producing countries.

European production has fallen off 6.8 per cent during the past fifteen years, while the countries of all other regions have increased their output as the result of economic encouragement which came to the surface locally during the war period and since. These new producing countries easily account for between half a million tons which to some extent has been subtracted from European exports and to no inconsiderable extent from those of the United States.

Today the United States alone, of all countries, has doubled its output as compared with that of 1913. With Great Britain, Italy and Japan and France it has also doubled its home consumption. France, actually because of the rebuilding operations of the devastated war zone, has increased its interior consumption more than 400 per cent.

The European industry has largely increased its export during this period, though Germany, curiously, not at all, with its accredited 1,061.198 metric tons in 1928, due to a reduced national output which itself is caused by the curtailment of its former territory in conformity with the Treaty of Versailles.

Belgium shows an increase of exports of 104 per cent; Denmark—109 per cent; France—61 per cent; Great Britain—23 per cent; Norway—2,500 per cent; Sweden, Norway's neighbor, by an anomaly, just holds its own. At the other end of the world Japan has increased exports by 564 per cent.

It would be interesting and of value to the American industry to know just where the 682,128 metric tons exported in 1913 went to and who has got this share of export trade since. The following lines briefly suggest what may have happened, also why and how, always admitting that the American manufacturer in general has gone after export business which pays the best and leaves the greatest volume of wages in the home country—highly fabricated wares as against raw and semi-raw materials. Wages paid in the American cement industry and those paid in Europe, by contrast, may account for much.

In general, imports in countries where the industry is highly developed are small as compared to the national output—Great Britain, 8 per cent—France 4 per cent—the former, however, exports 15 per cent and the latter 9.8 per cent. Germany's imports and exports are, respectively, 0.94 per cent and 16.17 per cent.

Of the world's exports, which have increased 32 per cent since the war by the essentially exporting countries, those of Europe are credited with 91 per cent as against 84 per cent in 1913. This is largely accounted for by the new frontiers since laid down in Europe, certain output formerly delivered to national consumers now, by the rectification of boundaries, actually goes to foreign countries. This rearrangement of frontiers has brought about a consequent rearrangement of statistics.

Exports in 1928 were greatest from Belgium, Germany, Great Britain and France and imports bulked the largest with Holland, Great Britain and France.

Home consumption in 1928 was greatest in Germany (6,167,000 metric tons), France, Great Britain and Italy, Germany's consumption was but one-fifth that of the United States, though her population is less than half.

In general, imports are smaller as duties (as is shown elsewhere) are higher, which seems to prove the virtues of protectionism.

The organization of the European industry in almost every instance shows a tendency towards rationalism in every accepted sense of the word. National associations, so to call them, practically

control the industry. Germany has four such which seek to limit production and sales quotas among their members. The Deutscher Zementbund, a central office, at Berlin is the parent organization. The following group the great bulk of German manufacturers:

(1) Norddeutscher Zementverbad—Berlin.
(2) Westdeutscher Zementverbad—Bochum.
(3) Suddeutscher Zementverbad—Heidelberg.
(4) Hutten Zementverbad—Dusseldorf.

World's Cement Industry (Europe)

	(Cement Production) 1927——metric tons	Imports 1928——metric tons	Exports 1928——metric tons
Austria	480,000	22,000	8,251
Belgium Luxemb'rg.	2,800,000	16,936	1,639,177
Bulgaria	80,000	140*	.....
Czecho-Slovakia	1,500,000	5,607	19,589
Denmark	643,000	1,842	335,266
Esthonia	85,000	58*	.....
Finland	205,000	78,000	85
France	5,100,000	155,000	639,726
Germany	7,275,000	144,312	1,061,198
Great Britain	4,950,000	281,000	924,901
Greece	112,000	71,000	.....
Hungary	417,000	2,054	14,283
Italy	2,558,000	10,044	12,663
Latvia	20,000	29,000	275
Norway	269,000	25,000	160,351
Poland	831,000	418	145,380
Portugal	.....	12,837*	443*
Roumania	226,000	2,770	
Jugo-Slavia	713,000	288	377,451
Spain	1,112,000	.....	.....
Sweden	500,000	28,219	137,785
Switzerland	537,000	9,579	40,451
Other Countries Excluding Russia	400,000	?	?
Holland	?	892,000	1,498
Ireland	.....	167,000*	.....
Lithuania	.....	47,000	.....
Russia Sovietic	2,125,000	.....	.....

*Figures for 1927.

Imports and Exports

Percentages of National Production

	Imports Per cent	Exports Per cent
Germany	0.94	16.17
Austria	4.75	1.75
Hungary	0.49	5.10
Italy	0.79	0.30
Poland	0.5	17.97
Jugo-Slavia	0.01	44.53
Switzerland	1.55	11.09
Czecho-Slovakia	0.32	1.38
Belgium	....	51.

In Spain the bulk of the trade is in the hands of the Asland Compania General de Asfaltos y Portland. A central office, in its activities, seems to be pointing the way to a Spanish monopoly of the traffic. In any case production has nearly tripled since 1913 and imports have fallen greatly. The interior consumption is around a million tons per annum.

The Belgian Union des Cimenteries groups nine important producers and the Federation des Cimentaries has control of the sale of the Belgian product except in Belgium, Luxembourg, Germany, France and Holland, which are reserved to the Union. Belgium moreover has a Groupment Professional des Fabricants de Ciment Portland Artificiel which, among other functions on behalf of its members, is carrying on an intensive propaganda of publicity urging the greater use of reinforced concrete as a means of increasing the consumption of two of the most important of Belgium's semi-raw materials.

The British industry is divided into two groups which together control 70 per cent of the total output of the country. The first is composed of the Ship Canal Portland Cement Company, Holboroughs, Greaves, Bull and Lakin, Dunstable and Smeed and Dean and Company. The second group is the Associated Portland Cement Company, the British Portland Cement, British Cement Products and Finance Company Ltd., which latter holds the shares of the Mexican Tolteca Company, 50 per cent of the British Columbia Cement Company and participation in other units in various parts of the world. Prices have been standardized by the two groups in common agreement, sales areas apportioned and competition for the most part eliminated. There appears to be some occult relation between these groups and the Portland Cement Selling and Distributing Company Ltd., made up of five associated producers, which has grown up mushroom-like since the war, and the Cement Marketing Federation, a sort of super-organization embracing most of the elments of the entire industry.

Switzerland's situation is interesting. The cement industry is organized in what is a very near approach to a cartel. The Eingetragene Genossenschaft Portland of Zurich apportions the quota production of each factory based upon the capacity output of the country's entire industry. Another organization, the Association Suisse des Fabriques de Ciment Portland, is a cooperative for the elimination of unfair competition and price fixing within the country according to zones.

Poland, which has come into being as a political entity since the war, has developed a cement syndicate, the Zentro-Zement, which groups the thirteen existing Polish plants.

International cement agreements have been arrived at in Europe in many cases with a view to the prevention of overlapping of interests and undue competition.

The Swiss and South and West German organizations have an agreement against impinging on each other's home territory, a like arrangement being in force with Austria. The North German and Swedish industries have a similar agreement, as also is that between North German interests and Czecho-Slovakia producers, while those of the East German district line up in similar fashion with those of Poland.

German and Belgian manufacturers had agreed to end their competition in the market in Holland, with which the newly established Dutch firm, the Eerste Nederlandsche Cement Industries at Maestrich joined. A Belgian element, the Comptoir des Chaux et Ciment de Touraises, with a yearly pro-

duction of half a million tons, denounced the accord which was abolished in the spring of 1929.

German and French producers have an agreement which came in force in April, 1929, which reserved the Saar market for the South German syndicate.

France, Belgium and Luxembourg have a joint agreement affecting trading by the other in their respective countries.

There has been created at Copenhagen, Denmark, an International Cement Syndicate, grouping certain Norwegian, German, Swedish, British and Belgian factories of an annual output of 50,000,000 barrels. It especially concerns itself with apportioning export quotas to South American countries.

In 1928 a proposed British-German cement agreement proved impossible of accomplishment.

There is rumor of a Franco-Swiss-Belgian accord between minor producers in these countries, but nothing definite appears to have been achieved.

Customs classification and tariff nomenclature are important features of the international cement trade. The Economic Section of the League of Nations has recently been studying the possibility of unification on these points to the end of simplifying the conditions of world trade.

Natural cements (trass, tufa, pozzolona and santorin earths) are usually classed as ores not otherwise denominated. Artificial cements are divided into the quick-setting varieties—aluminous cement, ciment-fondu, ciment noir, roman, etc., and the slow-setting cements—Portland, hydraulic, cinders, slag, compositions, etc. Usually the quick-setting cements benefit of a lower rate of duty, as in the case of France, Italy, Jugo-Slavia and Switzerland. Latvia alone takes the opposition stand and makes no distinction between the two.

Belgium, Denmark, Great Britain, Lithuania and Holland admit cement duty free. Norway and Latvia impose a duty of $0.055 per 220 lb. Germany stands at $0.178; Italy, $0.337; Switzerland, $0.258, and Czecho-Slovakia, $0.395.

Probably there is no little dumping, due to the "organizing" of certain national industries; it is certainly possible, though not recognized as a general practice. The only solution by producing countries would be for them to raise the tariff barrier still higher, or enter into international agreements of restrictions and contingents which has been done in certain cases, though the economists of Europe frown upon the practice; indeed, it has been one of the moot points of discussion in the meetings of the economic section of the League. Collective international trade agreements, covering certain special industries, are something to be looked forward to as possibilities of the future in Europe. It is either that or the bringing into being of an economic United States of Europe, as advanced by Monsieur Briand as French minister of foreign affairs, supported by Monsieur Loucheur as minister of labor, an industrial-capitalist himself, but recognizing full well his need of labor support. Herr Stresemann at the Hague conference, moreover, quite agreed with Monsieur Briand's idea. It may come to pass!

In 1927 Germany and Belgium were the largest exporters of cement to Holland—411,000 tons and 391,000 tons, respectively. Belgium also sent 319,000 tons to Great Britain and, incidentally, 237,000 tons to the United States; to the Argentine, 152,000 tons (double the quantity that country received from Germany), and 55,000 tons to Brazil, which, however, is but a third of the quantity which Brazil bought of Germany. Denmark has the favorable showing of 69,000 tons to Brazil and 42,000 tons to the Argentine. Sweden is credited with 55,000 tons to Brazil and 21,000 tons to the Argentine. France has but one large export buyer (apart from her North African protectorates)—Great Britain—for 114,000 tons.

Great Britain shares Brazil's trade to the extent of 40,000 tons and that of the Argentine for 25,000 tons. The bulk of her export trade is with the British Colonies and protectorates—600,000 tons.

Egypt buys 120,000 tons from Jugo Slavia, which is about half of her total imports. Morocco, Tunisia and Algeria, collectively, take 150,000 tons. The group forms France's largest customer.

Such figures as these make those referring to the export of cement from the United States appear ludicrous—18,000 tons to Venezuela, as compared with Germany's shipments to that country of 54,000 tons in the year; to Panama, 15,000 tons, while Germany actually comes through with 9,000 tons. Germany's shipments of 79,000 tons to the Argentine (though only half of those of Belgium) are overwhelming when they are lined up with those from the United States, a bare 8,000 tons. Only in Cuba, with 18,000 tons, do we beat out Germany with 6,000 tons, if we except Panama, which is an anomaly. Denmark even sends 31,000 tons to Porto Rico. Japan's industry has found almost a monopoly for its product in the Dutch East Indies—109,700 tons, as against 49,000 tons from Germany. Japan also sends 34,100 tons to the Philippines.

Considering that the interior market price in the United States, reduced to the 100 kilo basis, ranged, during the past three years, from $0.95 to $1.06, and the United States production is nominally 30 million metric tons, as compared with 7,570,000 tons for Germany, 5,100,000 for France and 5,000,000 for Great Britain (with their respective home consumption prices of $1.08, $1.09 and $1.29), it seems remarkable that more export business is not done, particularly in Central and South America, where, with a short haul by

water, there is every advantage over European exporters.

European home market prices of artificial portland cement:

		Per 100 kilos (200 lb.)	
		to	
Germany	July 1928	$1.08	$1.32
Austria	January 1927	1.13	1.17
Belgium	July 1928	.47	
Czecho-Slovakia	January 1927	.87	
Denmark	1927	.99	
Spain	June 1927	1.66	
France	April 1928	1.09	
Great Britain	July 1927	1.29	1.33
Hungary	June 1928	1.03	1.09
Italy	January 1928	.92	1.16
Luxembourg	May 1927	.47	
Norway	January 1929	1.35	
Holland	May 1928	.88	
Poland		.78	
Jugo-Slavia	1928	.97	
Sweden	April 1927	1.48	
Switzerland	July 1928	1.27	
Turkey	1928	.97	

The American producer and shipper of cement must find it galling at times when in a Central or South American port he sees the familiar German trademarked product—"Germania," the Danish—"Wico," or the Belgian "Vultur."

It is to be remarked that of all world producing countries Belgium alone (with which is allied in economic union, Luxembourg), not even excepting Japan, offers a really low priced commodity on the market—$0.47 the 100 kilos, less than 44% of the American price. Of a production of 2,800,000 tons, 1,639,000 tons are exported—51%—the largest export in proportion to production of any European country.

Most European cement producing countries favor their export industry by granting greatly reduced freight rates to tidewater.

	Per cent	Per cent
	to	
Germany	24	26
Belgium	46	52
France	13	32
Hungary	53	68
Italy	15	
Poland	24	44
Roumania	50	58
Jugo-Slavia	9	43
Czecho-Slovakia	10	

As many of these hauls by rail go over government owned state railways, this amounts to practically a subsidy, doubtless arrived at by lobbied legislation, which in turn is nothing more than class legislation. Such are the economic standards of Europe.

Manufacturers' Division of N. S. and G. A. to Hold Annual Meeting

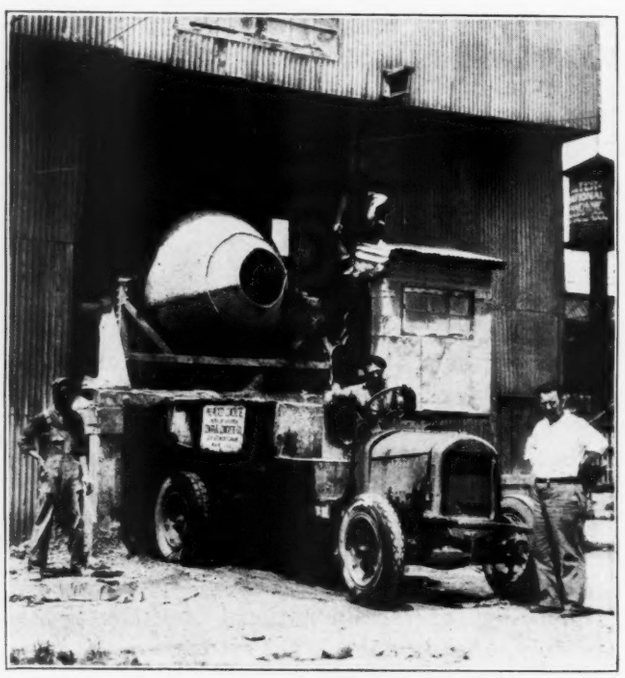
The Manufacturers' Division of the National Sand and Gravel Association will hold its annual meeting at the Pennsylvania Hotel, New York City, beginning with a dinner at 6 o'clock, Tuesday, September 17. The meeting will extend over until the following day, at which time arrangements will be made with respect to the exhibit of machinery and equipment at the Fourteenth Annual Convention of the National Sand and Gravel Association in Memphis, Tenn., on January 28, 29, and 30, 1930.

A number of important questions will be submitted for the consideration of the manufacturers at the meeting in New York, and it is particularly desirable that all members of the Manufacturers' Division should be represented. The annual election of officers will be held at this meeting rather than at the time of the annual convention of the Association; and a committee on the allocation of space will be appointed at the meeting. This is a departure from the previous practice and the views of every member of the Manufacturers' Division would be helpful.

Two Pioneers

(*Continued from page* 82)

pany; other trucks are hired. Concrete is shipped largely to public utilities companies for repair work and to the smaller contractors.



Truck Ready for Load at Central Concrete Company's Plant

Any waste or left-over concrete is made into flag-stone for gardens and other similar products. Winter operation is made possible by a boiler and steam line for heating the water and aggregate, which will heat the concrete to a temperature of over 80 degrees in the coldest weather.

R. F. Lee, president and general manager; J. B. Shepard, vice president and treasurer; and L. M. Dean, secretary, maintain their offices on the property.

Canada Gypsum and Alabastine Operates Second Oldest Discovery on This Continent

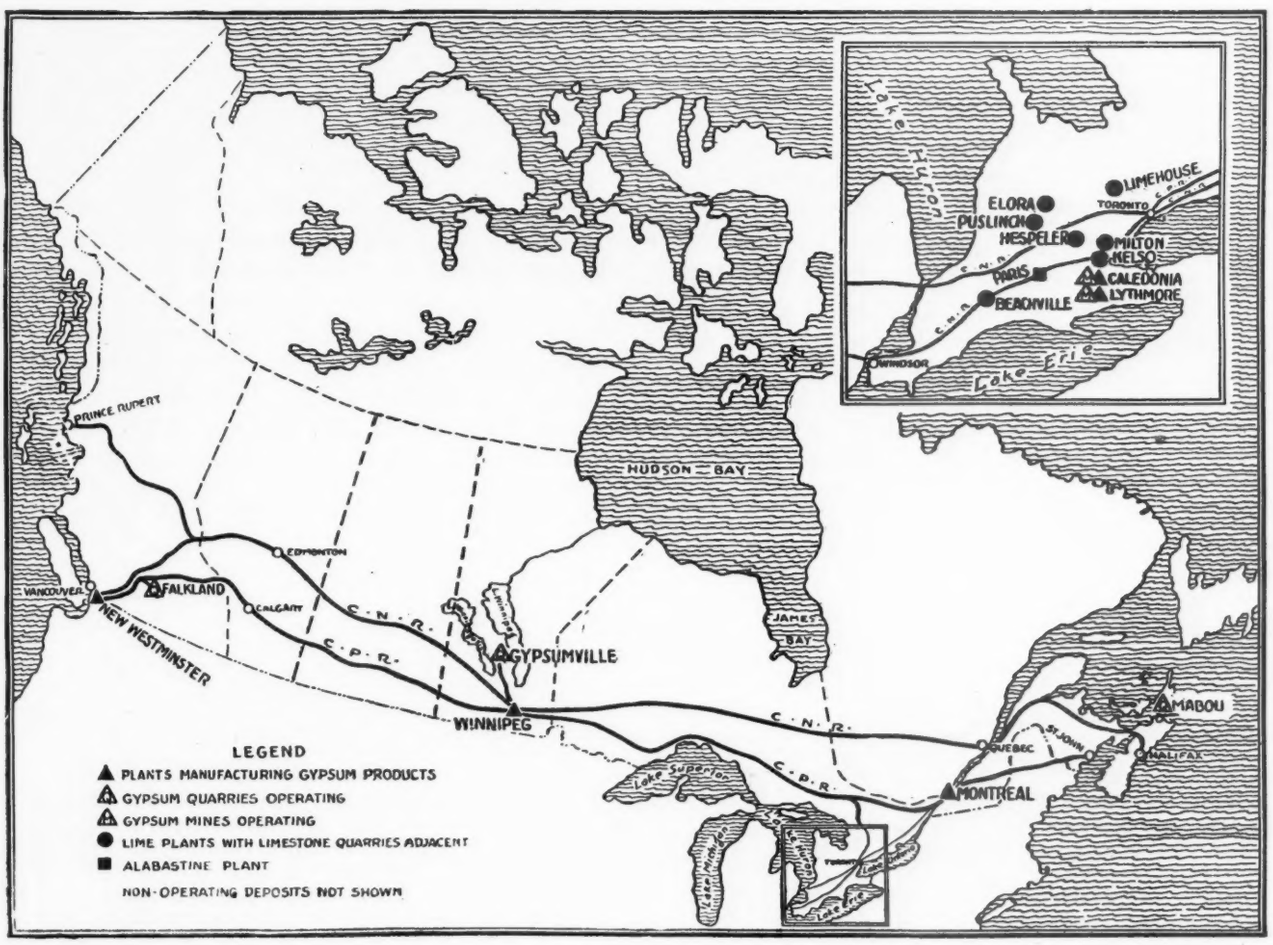
Production Includes Calcined Gypsum, Gypsum Blocks and Gypsum Boards

ONTARIO gypsum operations are dominated by Canada Gypsum and Alabastine, Limited. The oldest predecessor of this company, The Alabastine Company of Paris, was incorporated in 1886 and has since been in continuous operation. The first plant of this company was at Paris, Ontario, where Alabastine was manufactured. After beginning gypsum operations at Caledonia in 1905, the Alabastine Company's gypsum operations were amalgamated with the Crown Gypsum Company, forming the Ontario Gypsum Company, with the Alabastine Company retaining the controlling interest.

The present company, Canada Gypsum and Alabastine, Limited, was incorporated in August, 1927, to take over the operations of the Alabastine Company, The Ontario Gypsum Company and the Nova Scotia Coal and Gypsum Company, Ltd., mining gypsum rock at Mabou, N. S. In March, 1928, the Manitoba Gypsum Company and the British Columbia Gypsum Company were added to the Canada Gypsum and Alabastine interests to give a coast-to-coast production in Canada.

The history of the gypsum industry in the province of Ontario, Canada, dates back to 1822, when William Holmes opened a bed of gypsum near what is now the town of Paris. This was the second gypsum discovery in North America, New York state being first in 1792; Michigan followed in 1823, and Ohio in 1849. As in the United States, the market for many years was a local one, the product being used for fertilizer or land plaster. The first mill for grinding gypsum in Ontario was built in 1823 and the first calcining was done about 1846.

The gypsum deposits in southwestern Ontario are of the interbedded variety, the beds being separated by shales and limestones. The deposits that have been exploited are found in the Grand River basin north of the eastern end of Lake Erie. The



Sketch-map showing plants of Canada Gypsum and Alabastine, Ltd. The Caledonia plant is indicated in the insert

J. F. Cameron, general sales manager, Canada Gypsum and Alabastine, Ltd.

gypsum beds vary in number in different places, and range in thickness from several inches to 12 or 14 ft. The shale and limestone which divide the beds also range from thin bands to layers several feet thick.

The Caledonia Mine

The Caledonia mine and plant is about one-half mile north of the town of Caledonia, Haldimand County, Ontario, and about 14 miles southwest of the city of Hamilton, on the Canadian National Railway. The property consists of 497 acres of owned land, as well as leases on adjoining properties.

The mine was opened in the fall of 1905, when an incline was driven to a level 65 ft. below the surface. Production began in 1906 when a crushing plant was built. Some of the crushed rock was sold to cement manufacturers and the remainder sent to Paris for calcination. The output at that time was 60 tons a day.

The bed of gypsum at this level was 8 ft. thick and was overlain by a bed of limestone varying from 6 in. to 6 ft. in thickness. Above this was hard-pan and underneath the gypsum another bed of limestone. The gypsum was interstratified with layers of shale which necessitated hand picking of the rock, the waste material being left in the mine for filling. Large quantities of timber were required to support the roof.

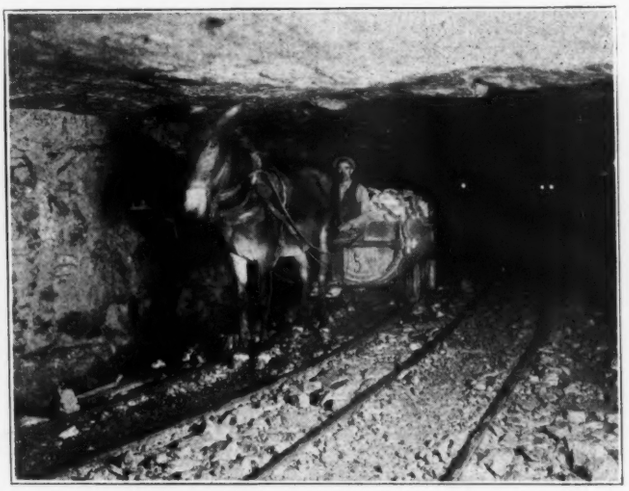
A small shaft was sunk a short distance to a bed of higher grade gypsum that was discovered at a depth of 87 ft. below the surface. The incline was extended to this level and the first level abandoned in 1910. This bed, which is being mined at present,

Loading gypsum rock in Caledonia mine

averages over 10 ft. in thickness. No hand sorting need be done as this bed is entirely free from shale.

A third level, 20 ft. below the second, was opened in 1913. Access to this was gained by an incline sunk about 400 ft. north of the main adit. A 3-ft. bed of clear, white gypsum unmixed with limestone was found. This was worked until 1916, when it was abandoned. This level, however, may be reopened later.

General view of Caledonia plant of



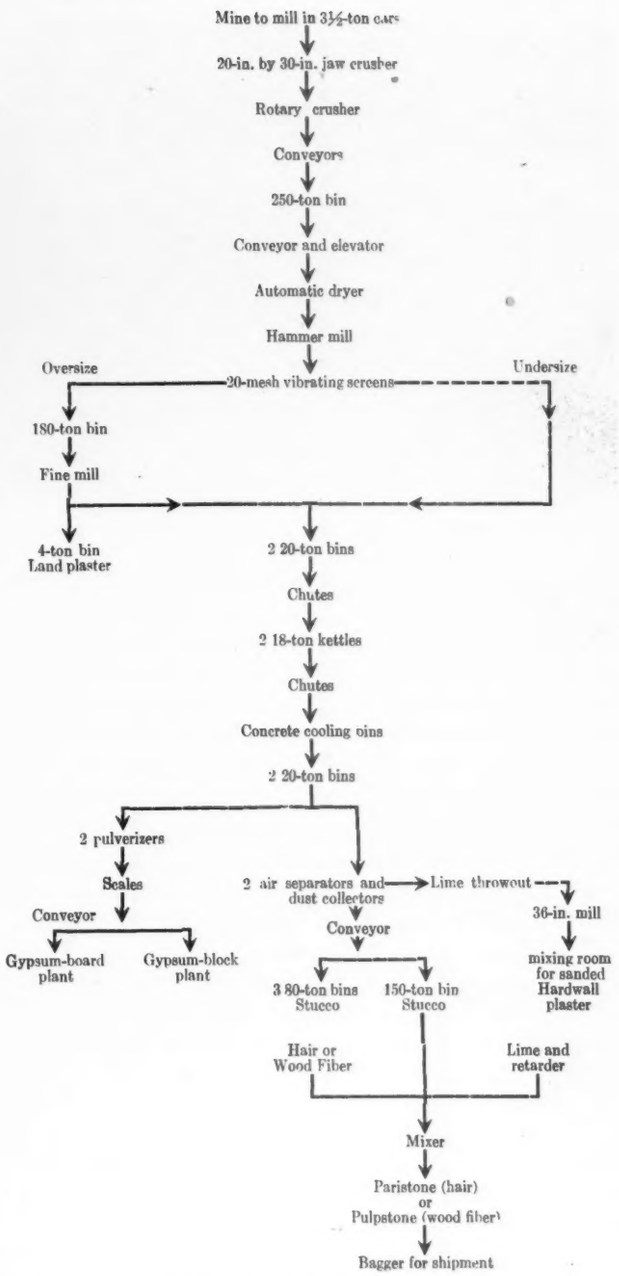
Underground haulage of rock

About 80 acres have been mined from the second level. The original working gave only a 55 per cent recovery, but this is being gone over with a total recovery of 85 per cent. The original room-and-wall system has been worked down into 24-ft. rooms and 12-ft. pillars with a factor of safety of 50.

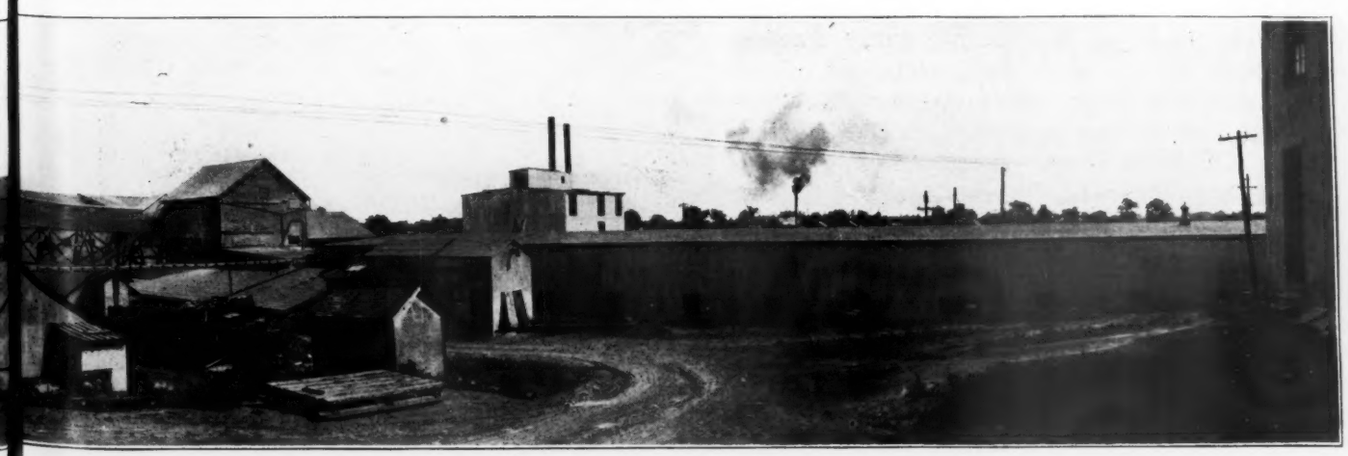
Mining

Drilling in the mine is done with four Jeffrey rotary electric drills of the coal-mine type. A 2-in. auger with a fish-tail bit, in lengths of from 3 to 12 ft., is used. This type of auger is necessary because the gypsum is intergrown with thin streaks of limestone. This limestone is removed in the plant by processing. Twelve holes are drilled into a face and loaded with 17- and 25-per cent dynamite, the stronger being placed at the bottom of the hole. About 60 tons of rock are broken down with each blast, or about 2 tons per pound of dynamite.

As each 3 ft. of rock is bored, the augers are sent back to the blacksmith shop for regrinding and retempering. This shop is located on the second level in an unused section of the workings and is completely equipped for this work. Tracks for



Flowsheet, Caledonia gypsum mill



Canada Gypsum and Alabastine, Ltd.

Showing typical pillars in mine

cars carrying these drils are connected up with the main tracks.

Lighting, pumping and ventilating of the mine are done electrically. In addition to the main adit there is a ventilation shaft in which is set a 72-in. disc fan. A 60-in. booster fan is set near the incline. These furnish about 8,000 cu. ft. of air per min. The flow of air can be reversed so that, in summer, the warm air coming into the drift keeps the shaft dry, while, in winter, the air coming out of the mine keeps it from freezing. The temperature in the mine does not vary more than 5 deg. F. during the year. The ventilation shaft is also an auxiliary outlet for the workers. The mine is drained into sumps from which the water is pumped by centrifugal pumps with a total capacity of 1,340 g.p.m.

Plant Operations

The rock in the mine is loaded by hand into 3½-ton cars made by the Philip Gies Foundry and hauled to the foot of the incline by mules. Here the cars are weighed on a Gurney Scale Company 10-ton-capacity track scale. They are then hauled up the 720-ft. incline by a single-drum hoist located in the crusher house.

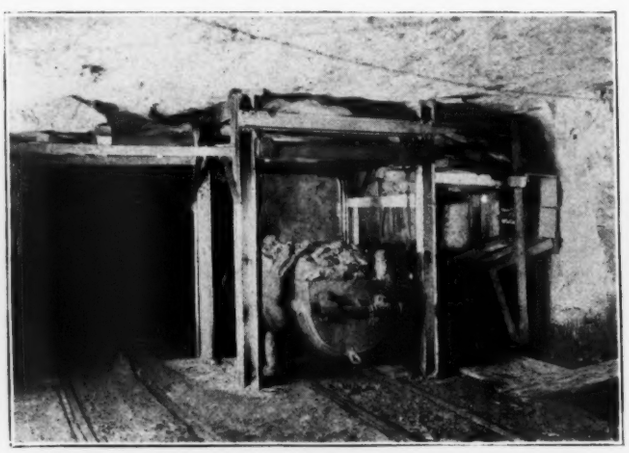
The cars are dumped into a Butterworth and Lowe 20-in. by 30-in. jaw crusher which reduces the material to 3-in. size. This discharges into a Butterworth and Lowe rotary crusher which reduces the rock further to ½-in. size. Part of the product is diverted directly from this crusher for use in cement plants and the remainder to a bucket elevator, belt conveyor and screw conveyor to a 250-ton capacity storage bin. This discharges at the bottom through a shuttle feeder onto a conveyor and elevator feeding a Huillard and Mourgeon vertical continuous dryer which reduces the moisture content of the gypsum from 25 to 16 per cent. This dryer is of brick with rotating steel paddles and perforated plates, and is of a type commonly used in France for drying silica sand, and in America for roasting sulphide ores. It is fitted with self-registering thermometers and burns coke fuel which does not alter the chemical composition of the gypsum. A collecting system saves the fine dust rising with the vapor.

The dryer discharges onto a revolving table which feeds a Pennsylvania Size No. S4 hammermill. The product of this mill is then elevated to Mitchell 20-mesh single-deck vibrating screens through which about 70 per cent of the product will pass. The oversize goes to a 20-ton bin from which it is fed into a Kent Maxecon mill which grinds to 20-mesh. This feeds back to the screens in a closed circuit, finally going to a 75-ton land plaster bin or to two 20-ton storage bins. The undersize goes directly to these bins. Some of the coarse material is diverted and sold as chicken grit.

The bins discharge through chutes into two 18-ton capacity calcining kettles. These are steel plate cylinders 10 ft. in diameter by 10 ft. high, under which are masonry fire-boxes. Around each kettle is a brick jacket 15 in. thick, with an air space of 13 in. The heat plays on the bottom of the kettles, but the draft is arranged to take most of the heat to the sides and through four 12-in. horizontal flues. A mechanical agitator revolves at 15 r.p.m. and tends to force the gypsum toward the center.

The powdered gypsum is run slowly into the kettles until they are filled and the temperature gradually raised from 200 deg. F. until a temperature of about 275 deg. F. is reached. At about 230 deg. the steam formed in heating, aided by the mechanical agitation, causes the fine particles to float upward as if boiling. When the highest temperature is reached the boiling ceases and the material settles down to about 10 per cent less than its original volume. This is spoken of as "first settle" and means that most of the gypsum is dehydrated. This process takes from 1½ to 2 hours. The product is plaster of Paris ($CaSO_4\ \frac{1}{2}H_2O$) commonly called stucco.

The calcined material goes from the kettles through chutes into concrete cooling pits from



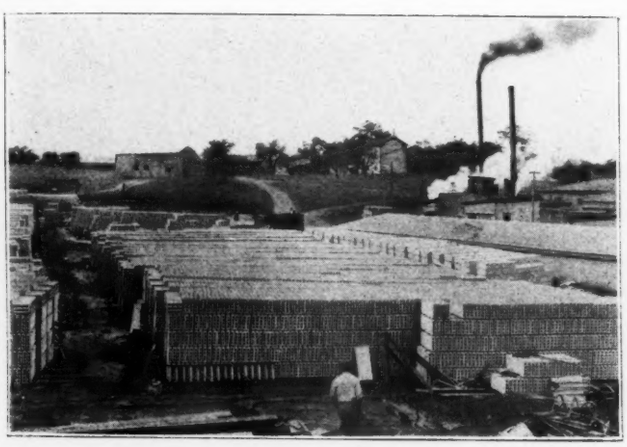
Weighing rock in the mine

which it is conveyed to two 20-ton steel storage bins. These tanks feed to two No. 3 Raymond mills and two Munson mills, the former being equipped with air separators while the latter turn out a completed product.

The coarse material from the Raymond mills goes to a separate bin while the fines go with the product of the Munson mills. Each Raymond mill is driven by a 20-h. p. Westinghouse motor through Link-Belt silent-chain drives. This material will pass 95 per cent through a 100-mesh sieve. It is sent either direct to the gypsum board or block plants or may be further refined for stucco wall plaster.

The coarse material, which was formerly wasted, contains from 30 to 40 per cent gypsum, the remainder being limestone and impurities. This goes to a 36-in. Sturtevant mill where it is reground, the product being sent to the mixing room where lime and retarder are added to make a "sanded" hardwall plaster in which the limestone takes the place of the sand usually added. From 1½ to 4 lb. of goat hair is used per ton of product for strengthening according to the type required.

The fine plaster of Paris is weighed in the conveyor from the mills to the bins on a Richardson scale. The material is then conveyed and elevated to storage in three 80-ton bins, with a 150-ton bin for stucco, or to a 20-ton bin from which it may be drawn through a Standard Scale Company weighing hopper into either of two Broughton mixers which have a capacity of one-half ton and one ton respectively. In these mixers any of the hardwall plasters can be made. In all of these plasters stucco and retarder are used, with wood fibre as a filler in some, and hair and hydrated lime in others. The mixers feed to two Bates 3-bag packers where the material is packed into 50-lb. capacity multi-wall paper bags. All operations in the mill building where dust is raised such as dryers, kettles, and conveyors, are connected with a By-Products Recoveries, Inc., dust collector where from 8 to 10 tons of valuable dust are recovered daily.



Air drying of partition tile

Drilling underground in Caledonia mine

The Board Mill

The manufacture of gypsum or plaster board at Caledonia was begun in 1919. A short-belt system which was employed had a limited output. In 1920 an addition was made for an increased length of belt and longer kilns. In 1928 the plant was again enlarged and a Coe dryer installed. The 52-in.-wide board-belt is 690 ft. long, perhaps the longest in any gypsum plant. The dryer is 438 ft. long and has 11½ miles of 1½-in. pipe 6 decks high inside of it. A similar machine 60 ft. long was recently completed for making samples of board, which are made here for all of the company's plants.

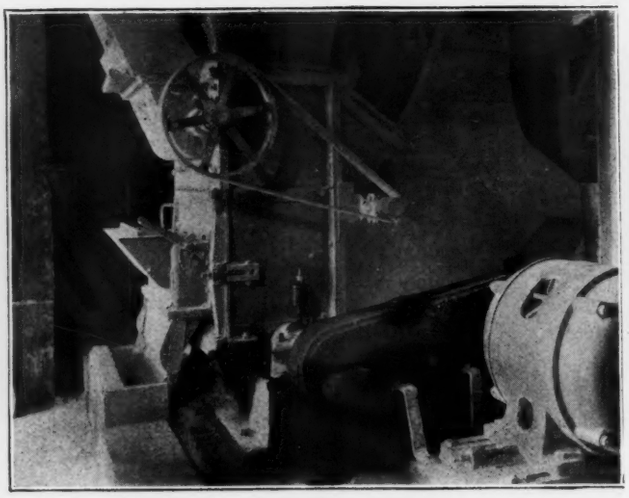
Stucco is conveyed from the plaster mill by a screw conveyor to a bin in the board plant. The stucco then passes into a hopper which fedes onto a 30-ft. soak belt and then goes to a mixer of the company's own design where several other ingredients are added. Boards are being made under the Haggerty patents for starch board, but original and exclusive features have been added.

The mixture feeds from the mixer onto sheets of paper varying in width according to widths of board fabricated. The top paper then comes under the top squeeze roll which regulates the thickness of the board and the edges are automatically folded and sealed. The board then goes onto the main carrier belt where it passes between two sets of rubber smoothing belts.

The speed of the carrier belt is so regulated that the board is given ample time to set. The belt speed can be varied from 20 to 100 ft. per minute, according to the drying time of the size of board being made. The board is then cut into lengths of from 3 to 10 ft. as desired and taken to the dryer where they are kept for about 2 hours.

The dryers are maintained at a temperature of 225 to 325 deg. F. and they are equipped with Foxboro recording thermometers, speed recording tachometer, and special humidity control. Heat for the kilns is derived from steam furnished by a 400-hp. Erie City boiler with a Detroit underfeed

Gypsum tile being removed from machine



Discharge from Raymond mill

double-retort stoker. The dryer is operated under conditions evolved at this plant to give the most economical and efficient operation. The boards are then loaded onto a 5-ton Elwell Parker electric truck which will carry 186⅜-in. boards to the storage building which has a capacity for 1½ million feet of board.

The Block Plant

The block plant was built in 1920 and, in 1921, a storage building was erected. The stucco or calcined gypsum is brought from the plaster mill to a 60-ton bin from which the stucco can be drawn off as needed. The capacity of the plant for hand-molded tile is from 7,000 to 10,000 ft. per day. A Gibraltar machine, furnished by the Gypsum Engineering and Manufacturing Company, makes either solid or hollow blocks in sizes of from 2-in. by 12-in. by 30-in. to 8-in. by 12-in. by 30-in. It has a capacity of 1,000 ft, per hour. The blocks when finished are placed on cars and run into kilns where they are steam-dried for 2 days. These kilns have a capacity of 12,000 ft. in 24 hours.

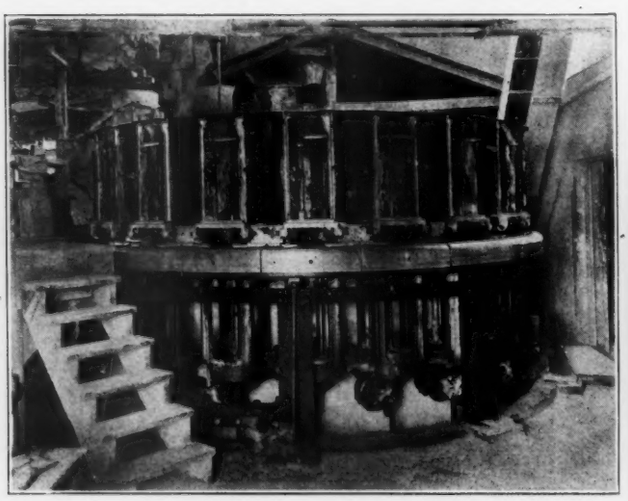
All types and sizes of partition and roof tile and beam fireproofing block are made. All hollow tile is made 13-in. by 30-in. These blocks can be cut with a saw, and nails can be driven into them without cracking or splitting. They are used for interior partitions, furring of walls and columns, fire walls, fireproof partitions, and for insulation.

Quality Control

A chemical and physical testing laboratory is maintained at the plant, in a separate building. Competent chemists and engineers carry on research and constantly supervise the quality of the products. Constant check is kept on all operations and a fully equipped testing laboratory is maintained in the plaster mill. Every batch of stucco from the kettles is tested for time of set and amount of moisture retained. Working qualities and compressive and tensile strengths are also tested.

Power House

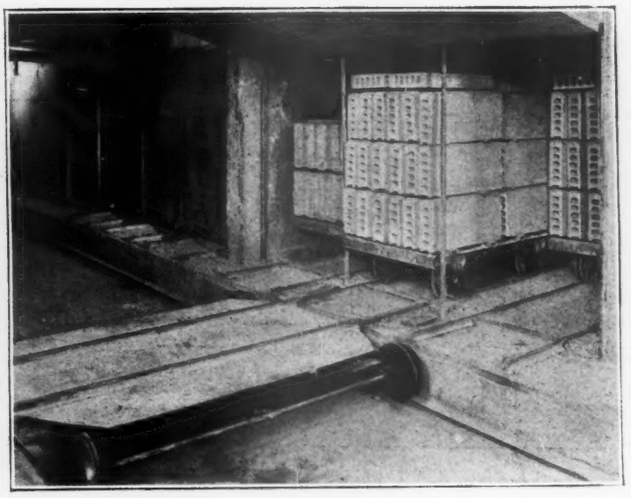
The power house at the plant is in the mill building and houses the motors which drive most of the mill machinery. Power is supplied from the Dundas substation of the Hydro Electric Commission of Ontario and is reduced to 250 volts for general plant operations.



Partition tile machine

Note load of rock, in middle distance, entering plant

Wallboard machine with run of 750 ft.



Partition tile entering kilns

A 250-hp. motor drives the main shaft from which most of the mill machinery is driven, through a multiple manila rope-drive. This shaft drives, by belt, a 250-volt d. c. generator which furnishes current for lighting and drilling and the primary and secondary crushers. A steel plate clutch connects this shaft with another from which are driven the Bates baggers, the conveyors and elevators, and the tailing grinding mill. The dryer is operated through an individual clutch. For emergency use in case of power failure a Bessemer 2-cylinder horizontal 75-hp. gas engine drives, by belt, a shaft which may be connected to the main shaft through a clutch. Another 200-hp. motor in the power house drives, by belt, the two boiling kettles, the Kent mill, the two air compressors and several conveyors.

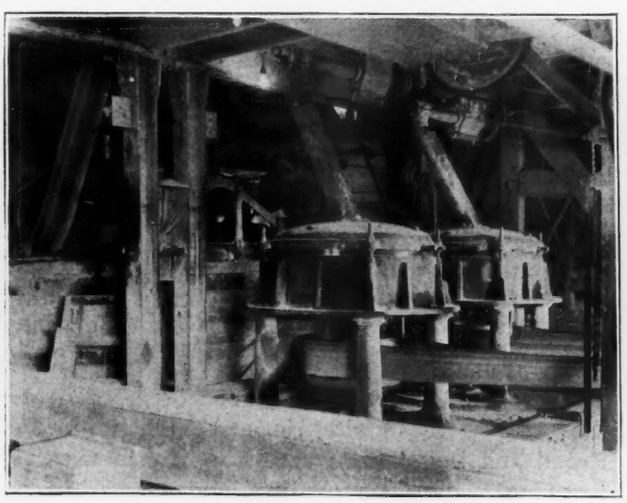
Changes Being Made or in Prospect

Numerous changes in mine and plant operations are being made and others are contemplated. The naturally smooth floors in the mine, in addition to simplifying the laying of track also make feasible the use of a mechanical loader which may be installed in the near future. The use of electric mine locomotives and air drills has also been considered.

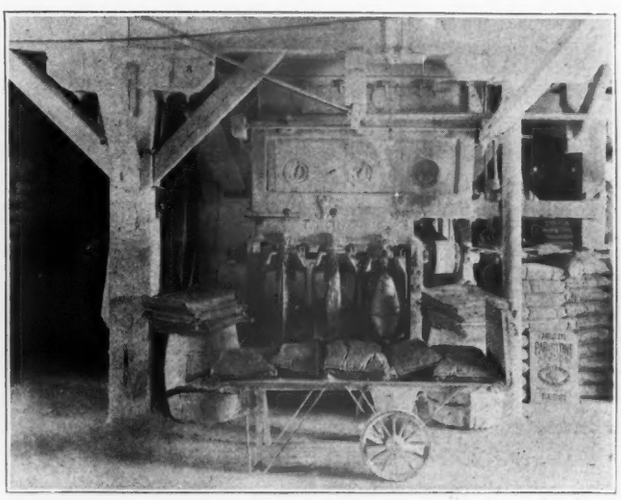
In the mill a Fuller-Kinyon 5-in. pump was recently installed to convey the plaster from the mill to the board and block plants. A pipe-line to each of these plants allows material to be conveyed to them one at a time. The pump is driven by a 50-hp. motor through a Hans Renold silent-chain drive. The two air compressors at the plant, together with a temporary compressor, are furnishing air for the pump until a larger compressor capable of handling 750 cu. ft. of free air at 100-lb. pressure is installed, which will be within a few weeks.

Employee's Welfare

In the past the company's efforts for the welfare of the employees were devoted almost entirely to the problem of safety. The results obtained were decidedly encouraging. In the 25 years that the mine and plant have been operating there have been very few accidents and no fatalities, although more then 150 men are employed, 40 of these in the mine. There are baseball, hockey and soccer teams, and lawn and alley bowling rinks for the athleti-



Regrinding gypsum rock



Bagging Paristone Hardwall plaster

Looking down upon partition tile machine.

cally inclined. Games are played between the various plants of the company.

A banquet hall is being built on a hill above the plant, for dealers conventions and employee's gatherings. These meetings were formerly held in a worked-out section of the mine where electric lights and benches had been provided. The new building will have a number of unusual features. The walls and ceilings will be made of different types of the products which are made at the plant.

Another concession made to employees is that they are given the opportunity to buy stock in the company on long terms at low prices. This plan works out satisfactorily and has a good effect on the loyalty of the employees to the company.

Miscellaneous

Both Link-Belt and Dodge belt conveyors, screw conveyors and elevators are used throughout the plant. The conveyor belting is mostly Dunlop with some Goodyear and Gutta Percha Rubber and Manufacturing Company. Most of the motors and electrical equipment were furnished by the Canadian General Electric Company, Crane valves and fittings are used. Reeves variable-speed drives on the block machine, board machine, and board drier allow accurate regulation of speeds.

A well stocked parts and equipment storehouse is located near the top of the incline from the mine, where replacement parts are kept for much of the operating machinery. A well equipped machine and blacksmith shop in connection contains a number of drill presses, bed-lathes, planer, hack-saw, forge, and a Smith Welding Equipment Corp. acetylene welding outfit.

Officers

R. E. Haire, president and general manager of Canada Gypsum and Alabastine, Ltd., has been connected with this firm and its predecessors for 36 years. J. F. Cameron, general sales manager, has been connected with the firm for over 15 years. Other officers are: S. H. J. Reid, secretary and treasurer; F. Andrews, purchasing agent; H. J. Haire, manager Alabastine Division: D. C. Nickle, manager chemical lime department: and Mace Mair, manager of sales promotion. Major George M. Thomson, a well known authority on non-metallic minerals, is director of research for the company; James Gavan, an international authority on insulation is consulting architect; L. V. Robinson, is manager of production at the Caledonia, Lythemore and Montreal East plants. At Caledonia, E. Senn is assistant superintendent; R. D. Kerr is mine superintendent; G. B. S. Jones is wall board superintendent, and Fred F. Harrison is superintendent of the block plant; Thomas Bouckley, ceramic engineer, is in charge of the quality and operations reseach department.

United States Consumes Much Of Canada's Mica Production

Exports of mica from the Dominion of Canada had a value of $93,556 for the fiscal year ended March 31, 1929, as compared with $107,335 for the corresponding period of the previous year. The United States was the Dominion's best customer for this product, taking a total of $89,415, as compared with $103,015 in the same twelve months of the previous year. Exports to the United Kingdom totalled $3,707, as against $3,300 in 1928.

Canada Has Substantial Asbestos Industry

Asbestos exports from Canada in July had a valuation of $889,418, as compared with $1,041,057 in the previous month, and $831,789 in the corresponding period of last year. Exports of asbestos sand and waste were valued at $249,129, as against $175,238 in July of 1928.

Frederic A. Reimer Is Touring South America

Honored by President Hoover with appointment to the United States delegation which attended the Second Pan American Highway Congress in Rio de Janeiro, Brazil, August 16-31, President Frederic A. Reimer, of The American Road Builders' Association, is now accompanying the delegation on a tour through South America and is expected to return to the United States in October.

Major Reimer was summoned with the other delegates to the White House before sailing for Brazil and the group was photographed with the President and given parting advice and instructions on behalf of the Government.

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.

E. J. Simons
President, Idaho Portland Cement Company
Pocatello, Idaho

Eighth Annual Asphalt Paving Conference

Program announcements for the Eighth Annual Asphalt Paving Conference, to be held at West Baden Springs, Indiana, October 28th to November 1st, next, are indicative of an interesting and instructive meeting, with numerous highway officials and engineers of national reputation presenting papers and participating in the oral discussions. The conference, as usual, will be under the auspices of The Asphalt Association, New York, Leroy M. Law, of St. Louis, president, and J. E. Pennybacker of New York, secretary and general manager, respectively; and The American Association of Asphalt Paving Technologists, W. J. Emmons, Ann Arbor, Mich., president, and C. A. Mullen of Montreal, Ontario, secretary.

An elaborate program of entertainment will include as features a special "county fair" evening, a banquet, dance, a bridge-tea for ladies and a golf tournament on the final day. Automobile tours and airplane flights are planned. Governors and state highway engineers, farm and motor association officials are expected to attend.

Canadian Export Statistics

Exports of portland cement during the fiscal year ended March 31, 1929, amounted to 934,949 hundredweight worth $339,267 as compared with 900,202 hundredweight, valued at $310,730 in the previous twelve months. Exports to the United States amounted to 115,283 hundredweight as against 82,860 hundredweight in the previous year, valued at $78,674 and $47,288 respectively.

Feldspar

Exports of feldspar amounted to 28,613 tons valued at $229,970, of which 28,547 tons, worth $227,990, went to the United States. In the previous year exports of this material amounted to 31,174 tons, worth $251,994 and, of this, 31,134 tons valued at $250,854 went to our neighbor to the south.

Gypsum

Crude gypsum exports showed a sharp increase, advancing from 633,723 tons worth $1,041,824 in 1928 to 868,044 tons valued at $1,240,439 in the year under review. The entire exports went to the United States in both 1928 and 1929.

Lime

Lime exports totalled 433,100 hundredweight as compared with 411,055 hundredweight in the previous year. The values were 391,797 and $358,394 respectively. Again in this case over 95 per cent of the total exports went to the United States.

Crude and Manufactured Asbestos

Exports of asbestos during the fiscal year ended March 31, 1929, from the Dominion of Canada amounted to 134,062 tons valued at $9,090,392 as compared with 129,402 tons valued at $8,549,366 in the corresponding twelve months of the previous year. Exports to the United States amounted to 85,477 tons valued at $5,401,593 as against 74,179 tons worth $4,606,536 in the same period of last year. Exports to the United Kingdom for the period under review totalled 66,151 tons as against 11,064 tons for the previous year. The value of the exports to the U. K. was 504,555 and $767,465 respectively.

Exports of asbestos sand for the period under review totalled 134,807 tons, of which 126,196 tons went to the U. S. and 1,729 tons to the United Kingdom. The value of the total exported was $2,176,796 while the amount exported to the United States was worth $1,977,836.

Manufactured asbestos exports were valued at $76,043 as compared with $48,162 in the previous year. Exports of this class of goods to the United States were valued at $26,015 as against $17,241 in the same period of 1928.

Domestic Graphite Sold In 1928

The total quantity of graphite sold by graphite miners in the United States in 1928 and its value were considerably larger than the corresponding figures for 1927, according to a statement by the United States Bureau of Mines, Department of Commerce. The following statistics of sales of graphite were collected in cooperation with the Geological Surveys of Alabama, Georgia, Michigan, and Texas. The sales of natural graphite by producers in 1928 were 5,611 short tons, valued at $297,093, an increase of 404 tons, or 8 per cent in quantity, and $64,122, or 28 per cent in value, compared with 1927. The increase in quantity of sales was chiefly in the amorphous variety, the crystalline variety increasing in quantity only slightly. The total sales included 2,994 tons of amorphous and 2,617 tons of crystalline graphite. This was an increase of 399 tons, or 15 per cent in the former but only over 4 tons (8,900 pounds) or 0.2 per cent in the latter. The value of the amorphous variety increased $7,470, or 21 per cent, and the crystalline variety increased in value $56,652, or 29 per cent, compared with 1927. The quantity and value of crystalline graphite sold in 1928 were the largest since 1920.

The States reporting sales in 1928 were Alabama, Georgia, Michigan, Nevada, Rhode Island, and Texas. Texas was the leading State in the sales of crystalline graphite in 1928.

The foregoing figures represent the sales of shipments of graphite. The production figures are somewhat different. Only one amorphous graphite mine was in operation in 1928, that of the Carson Black Lead Company in Nevada. Two others made sales or used material from stock mined previously. The production of crystalline graphite in 1928 was 5,500,000 pounds.

The imports of graphite in 1928 amounted to 17,569 short tons, valued at $801,559, compared with 17,452 short tons, valued at $723,933 in 1927, an increase of less than 1 per cent in quantity, and of 11 per cent in value.

Potash from Leucite And Alunite

With the passage by Congress of the Winter Bill (H. R. 496) the way is open for a further extension of investigations into the potash resources of the country, says the United States Bureau of Mines, Department of Commerce.

Previous governmental investigations had been limited to the exploration for potash deposits in Texas and New Mexico, which geological data indicated as being present but which had not been proven. The United States Geological Survey participated by locating the most promising sections for drilling. Following this the Bureau of Mines has carried on a comprehensive diamond drilling campaign and laboratory study of the drill cores.

By the provisions of the Winter Bill investigations are authorized to cover other potash minerals, such as the leucites and alunites, greensands and other potash ores. The bill provides that investigations shall be carried on by both the Bureau of Mines of the Department of Commerce and the Bureau of Chemistry and Soils of the Department of Agriculture.

J. R. Thoenen, of the Bureau of Mines, is preparing to make a field study of the deposits in Wyoming and Utah with particular reference to the economic possibilities in exploiting these ores and the collection of samples for technologic study. This investigation will cover the location and accessibility of the deposits, mining costs, products made, extraction costs, and market possibilities.

Size Distribution of Finely Ground Powders

The determination of the size distribution of very finely ground powders is of considerable importance in the solution of problems connected with the properties of portland cements, of clays for ceramic purposes, of pigments, etc. Heretofore no satisfactory method has been available for the dry separation of finely powdered materials into sizes below 20-30 microns (one micron=1/25,000 of one inch). In connection with research on the utilization of anhydrite for retardation of portland cement, the Nonmetallic Minerals Experiment Station of the United States Bureau of Mines, Department of Commerce, in cooperation with Rutgers University at New Brunswick, N. J., has developed an air analyzer for fine powders. This machine is capable of making very clean-cut separations into sizes 0 to 5 micron, 5 to 10 micron, 10 to 20 micron, etc., of powdered gypsum, anhydrite, cement, clays, pigments, etc. The essential difference between the new machine and those used heretofore consists in avoiding constructions which result in very sudden changes of air velocity, and in the use of an all-metal apparatus which is carefully grounded so as to rapidly carry off electrostatic charges which are responsible for the sticking of the powder to the sides of the apparatus. A detailed description of this apparatus and the results obtainable with it is to be published in the near future as a Bureau of Mines technical paper.

Economics of Gypsum Industry

R. M. Santmyers, mineral specialist, United States Bureau of Mines, Department of Commerce, has completed a field trip in the course of which he visited gypsum deposits and plants in the New England States and the Maritime Provinces of Canada, for the purpose of obtaining information relative to the producing and distributing facilities of the gypsum industry. The information gathered is to be used in an economic study of the gypsum industry of the United States, Canada, and Mexico.

An interesting feature of the industry in Nova Scotia is the loading of the ships. The rise and fall of the tide, especially in the vicinity of the Minas Basin, reaches more than 40 feet, necessitating the use of flat bottomed vessels and specially built cribbing, as the ships are frequently high and dry at low tide.

Extraction of Potash From Wyoming Leucite

As part of a general program concerning the extraction of potash from a variety of raw materials, such as Texas polyhalite and New Jersey greensands, the Nonmetallic Minerals Experiment Station of the United States Bureau of Mines, Department of Commerce, in cooperation with Rutgers University at New Brunswick, New Jersey, has started some research on the extraction of potash from Wyoming leucite. This material is a potash-bearing silicate which is readily attacked by acids, which dissolve the potash and alumina leaving a siliceous skeleton of the original mineral. Another process depends upon the digestion of leucite with alkalies under pressure.

An economic analysis of various proposed methods for the extraction of potash from leucite has been started. From the cost of the raw materials required, and the estimated return from the sale of the products, the maximum amount of money available for treatment, overhead, freight and profit is being determined. In this manner, a few of the more favorable processes are being selected for chemical engineering studies.

Gypsum Products for 1928 Were Enough to Build a Big City

While the total output of crude gypsum in 1928 fell below that of the previous year, in both quantity and value, and was the lowest since 1924, the output of certain products manufactured from gypsum for use in building construction showed a remarkable growth over recent years according to a report on the gypsum industry shortly to be issued by the United States Bureau of Mines, Department of Commerce.

The total sales of plaster board, lath and wall board in 1928 was 844,377,416 square feet, or 711,990 short tons, and represents a quantity sufficient for the construction of approximately 210,000 homes, each containing 6 rooms, enough to house the population of a city about the size of Boston.

The sales of plaster board and lath in 1928 was 284,440,741 square feet, equivalent to 252,813 short tons valued at $4,107,848 as compared with 280,397,045 square feet equivalent to 249,219 tons valued at $4,669,562 in 1927, a small increase in quantity (footage) and a decrease of 12 per cent in value. The output in 1928 of plaster board was enough to cover the walls of approximately 70,000 homes of the average 6-room type (approximately 4000 square feet per house).

The sales of wall-board in 1928 showed a decided increase in quantity over the previous year; 559,936,675 square feet or 459,177 short tons valued at $9,046,926 as compared with 506,163,443 square feet, or 415,082 tons valued at $11,165,965 in 1927, an increase of 11 per cent in quantity (footage) and a decrease of 19 per cent in value.

Sanded plaster showed an increase in quantity over 1927; 245,617 short tons, valued at $1,314,480 as compared with 207,210 tons, valued at $1,414,749 for the previous year, an increase of 19 per cent in quantity and a decrease of 7 per cent in value.

Keenes cement, another gypsum plaster used largely as a wall finish, showed an increase in sales in 1928: 54,020 short tons, valued at $848,504, as compared with 41,431 short tons, valued at $674,698 in 1927, an increase of 30 per cent in quantity and 26 per cent in value.

Canadian Asbestos Production

Manufactures of asbestos and allied products in Canada, for the fourth year in succession, reached a new high value in 1928 at $2,050,032. In 1927 the output was valued at $1,663,300 and in 1926 at $1,530,094. Returns were received by the Dominion Bureau of Statistics at Ottawa, from 14 concerns, of which five were in Ontario, four in Quebec, three in British Columbia, one in Nova Scotia and one in Manitoba. Eleven of these firms made asbestos brake lining, packings, pipe covering, lumber shingles, etc., and the other three made magnesite stucco and flooring.

Capital employed by these concerns amounted to $3,064,164; the average number of employees was 345; payments for salaries and wages totaled $421,448; materials cost $925,661 and the value added by manufacturing was $1,124,771.

Imports of asbestos products were valued at $835,887 in 1928 as against $671,882 in 1927, and exports, including mine shipments of crude asbestos and fibre, were appraised at $11,046,182 as compared with $10,801,645 in the previous year.

Mining Engineers Are Prominent Individuals In Pit and Quarry Industries

By H. Foster Bain*

IN 1871, when the American Institute of Mining Engineers was organized, specialization in engineering had but begun, if we compare the then States with the present. The coal men, iron masters, metal miners, chemists, statisticians, geologists and teachers who came together in the original group covered in their experience and practice the whole range of engineering as applied to the mineral industries and much besides. Of the great national engineering societies only the American Society of Civil Engineers was then in being. Neither mechanical nor electrical engineering had become sufficiently distinct to require differentiation, nor were the numbers following those lines of work large enough to support a representative national society. An engineer in those simple days, like the country doctor, was expected to turn his hand to anything and, as a matter of fact, the founders as a group were men whose training and experience enabled them with striking success to meet the problems of most diverse industries. With the birth of the new Institute, which was formed especially to afford a common meeting ground for the school trained engineer and the so-called practical man who had grown up in the works, the first major step was taken in differentiation among engineers whose work related mainly to the problems of civil life. The Civil Engineers themselves had long since fathered the first break in differentiating themselves from the military engineers, the pioneers of the whole profession.

There is no record clearly indicating that in founding the American Institute of Mining Engineers it was planned to divide the field with the American Society of Civil Engineers. A number of our founders were members of and some active in the older society and to this day there are many who find their activities overlap the two fields and who are hearty supporters of both organizations. It was rather that a group of engineers and operating officials, finding they were constantly dealing with a certain range of problems that had much in common, coalesced into a society which afforded an opportunity for mutual benefit through enlargement of acquaintance, exchange of information, and the filing of data in printed papers so as to make it permanently and widely available. The newly assembled group was primarily concerned with mining the raw materials out of which the great prosperity of the nation has since been built. The civil engineers, and later the mechanical and electricals, in the main directed the use of these materials. It was the searching out, mining, separating and preparing the different mineral materials in the crust of the earth that was the concern of the new group, and with all the specialization of late years and the growth of many societies devoted to special parts of this field, the mining engineers have held together, have grown and have prospered. The success of the organization and its present strength is its best justification and the best proof that there is a common thread that winds together the mineral extractive industries.

With expanding use and stiffening requirements on the part of the users, more and more care and effort have had to be devoted to the preparation of the minerals and metals before they go to their first markets. In recognition of this change the words "and Metallurgical" were some years since added to the title. But other important developments have taken place without requiring change in name. One of the largest groups in the Institute is concerned with the development of the petroleum industry, one which was hardly on the map in 1871. It is recognized in a Petroleum Division, which is a semi-autonimous organization within the Institute as is also now the Iron and Steel Division and the Institute of Metals. Other branches of the industry are recognized through Technical Committees each charged with keeping in touch with progress in its own field, holding meetings, organizing symposiums and securing for publication papers which collectively will comprise a true compendium of progress. The Milling Committee, for example, is comprised of 58 carefully selected members who watch development in crushing, screening, sizing, hydro-metallurgy and ore dressing in general. It holds one or more sessions per year, supplies many interesting papers, and not many significant developments long escape it. Of the whole membership, 797 ask for and receive regularly the publications inspired by this committee, a number larger than the total of many technical societies. Similarly, coal, mining geology, mining methods, mine ventilation, various branches of metallurgy and other branches are served by committees.

With the great increase in industry and the trend toward fire-proof and permanent structures, there has been an increasing shift of burden onto the non-metallic minerals. Steel skyscrapers require cement, brick, plaster, asbestos and many other non-metallic substances to make them habitable and complete, and the illustration is typical. The quantities of rock, sand, gravel, clay and similar materials that must now be annually won from the earth are much too large to be satisfied by use of the old pick, shovel and wheelbarrow methods. In order, too, to secure the right grade of material at the minimum cost and in a steady stream uninterrupted by weather conditions, an increasing amount of each of these materials is being taken from underground. In other words, non-metallic minerals producers are becoming miners and interested in the same problems as other miners. Whether a shaft be sunk to obtain limestone or gold ore, the methods will be essentially the same, and problems of ventilation, drainage, ground subsidence, management and organization run alike through coal, iron, metal and non-metal mines. The newcomers to this field have, if they care to draw upon it, an immense record of experience and accumulation of data filed by the mining engineers. Even in these days of mounting costs, large quantities of lead, zinc and copper ore are mined from underground at a cost of $1 per ton or less. One great gold mine in Alaska is now making a profit of roundly a million dollars per year mining and milling a gold ore that only contains 85 cents of recoverable value. It requires knowledge, skill, capital and courage to achieve such results but the fact that the material is gold ore is incidental. It might as well be any other mineral.

Not only underground but above mining experience is available that may well be called into service in the newer non-metallic mineral industries. Without in the least minimiz-

* Secretary, American Institute of Mining and Metallurgical Engineers.

ing the excellent work done by many large sand and gravel companies, it may be mentioned that in almost any part of the world, with a short season and high freight rates, gold-bearing placer ground containing 25 cents per cubic yard will attract capital and can be worked at a profit. Under more favorable conditions real profits have been made out of placers averaging 7 to 10 cents and in places where hydraulicking instead of dredging is permissible even lower grades can be worked. It is not surprising that several mining engineers, having had occasion to buy a few yards of sand or gravel near a city, have deserted gold mining and gone into the sand and gravel business.

In the mining of ceramic materials, the clays, feldspars and, in fact, in the general non-metallic mineral industries there is a great deal in the experience of the ore-dressing engineer that may be helpful. Fine grinding and sizing, whether wet or dry, is a necessity to his success and he has, through experiment and experience, built up a body of knowledge here which should be widely used. Those outside these industries are apt to think of a gold or a copper mine as a bonanza. Actually they are merely bodies of rock in place which, to be made useful, must be opened up, mined, crushed, sized, separated, smelted, refined—all this with necessary losses at each step and usually with the added cost due to desert or mountain location and a great distance from market. The Rand gold mines, now operating to a depth of 6,000 feet, are merely bodies of ordinary quartzite and grit, thoroughly cemented, and containing about $6 per ton over narrow widths in finely divided gold. But they are worked at a profit and the working of them changed the whole industrial map and the history of Africa. Copper mines in our own West have been worked at a satisfactory profit, despite heavy metallurgical losses then obtaining and all other unfavorable factors, when the total gross value per ton in the ground was well below $3; and lead and zinc mines have been so worked when the corresponding value was of the order of $1.25.

When account is taken of the usual situation in handling non-metallic minerals; namely, that the bulk of the mineral mined can be used instead of the reverse situation in metal mining, these facts present a cheerful outlook for the wider use of the non-metallic minerals without burdensome cost. By no means all non-metallic mining industries are free from losses corresponding to those in milling. The slate miners, for example, are almost in the same class as lead miners when it comes to mining much to sell little but, in general, the proportion the metal miner saves is roughly in inverse ratio to what his fellow practitioner in the other fields has to throw away.

A real and a broad field exists here for exchange of information, for pooling knowledge. Recognizing this, the Board of Directors in 1913 established a separate Technical Committee on Non-metallic Minerals and each year since facilities have been provided for sessions at the Institute meetings. The Committee is now constituted as below:

Chairman: Oliver Bowles, Chief Structural Materials Division, U. S. Bureau of Mines, Washington, D. C.
Vice-chairman: W. M. Weigel, Missouri Pacific R. R. Co., St. Louis, Mo.
Secretary: Arthur C. Avril, Avril Tru-Batch Concrete Inc., Cincinnati, Ohio.

General Committee

L. K. Armstrong, 722 Peyton Building, Spokane, Wash.
Charles H. Behre, Jr., Dept. of Geology, Univ. of Cincinnati, Cincinnati, O.
J. L. Gillson, Dept. of Geology, North Western University, Evanston, Ill.
Frank C. Hooper, Barton Mines Corp., No. Creek, Warren Co., N. Y.
A. J. Hoskin, PIT AND QUARRY, Chicago, Ill.
R. W. Hyde, Dwight & Lloyd Sintering Co., New York City.
Frank P. Knight, Jr., Tennessee Mineral Products Co., Spruce Pine, N. C.
Robert Linton, Pacific Clay Products, Los Angeles, Cal.
G. R. Mansfield, U. S. Geological Survey, Washington, D. C.
Walter F. Pond, State Geologist, Tennessee Div. of Geology, Nashville, Tenn.
Prof. Heinrich Ries, Cornell University, Ithaca, N. Y.
N. C. Rockwood, *"Rock Products,"* Chicago, Ill.
W. H. Runge, Alabama Marble Co., Gantts Quarry, Ala.
Hugh S. Spence, Mines Branch, Dept. of Mines of Canada, Ottawa, Ont., Can.
Joel H. Watkins, Charlotte Court House, Va.

Crushed Stone, Sand and Gravel

A. T. Goldbeck, Chairman, Director, Bureau of Engineering, National Crushed Stone Assn., Merchandise Bldg., Washington, D. C.
Arthur C. Avril—address above.
F. T. Gucker, The John T. Dyer Quarry Co., Philadelphia, Pa.
Hugh Haddow, Jr., Menantico Sand & Gravel Co., Millville, N. J.
M. L. Jacobs, Manager of Quarries, Bethlehem Mines Corp., Bethlehem, Pa.
J. E. Lamar, Ill. State Geol. Survey, Urbana, Ill.

Crushed Stone, Sand and Gravel

G. F. Loughlin, U. S. Geol. Survey, Washington, D. C.
J. R. Thoenen, Building Material Section, Bureau of Mines, Washington, D. C.

Cement

J. J. Porter, Chairman North American Cement Corp., Hagerstown, Md.
W. R. Dunn, Vulcanite Portland Cement Co., Phillipsburg, N. J.
B. F. Affleck, Universal Portland Cement Co., Chicago, Ill.
Herbert H. Lauer, Atlas Portland Cement Co., New York, N. Y.
John F. Magee, Alpha Portland Cement Co., Easton, Pa.
S. Warren Hartwell, Vulcanite Portland Cement Co., Easton, Pa.
E. D. Martin, Thomas A. Edison Inc., West Orange, N. J.

Lime and Gypsum

H. E. Brookby, Chairman U. S. Gypsum Co., Chicago, Ill.
H. J. Brown, West Newton, Mass.
R. E. Tremoureux, U. S. Lime Products Corp., San Francisco, Cal.
W. M. Myers, U. S. Gypsum Co., New York City.
Frank A. Wilder, Beaver Board Co., North Holston, Va.
L. G. Patterson, Lime Kilns, Amer. Cyanamid Co., Niagara Falls, Ont., Can.

Clay Products

George A. Bole, Chairman, Ohio State Exper. Sta., Ohio State Univ., Columbus, O.
F. W. Davis, International Combustion Engrg. Corp., Newark, N. J.
W. H. Fitch, Carborundum Co., Perth Amboy, N. J.
Prof. C. R. Forbes, Missouri School of Mines, Rolla, Mo.
Howells Frechette, Ceramics and Road Materials Div., Mines Branch Dept. of Mines, Ottawa, Ont., Can.
E. L. Messler, Pres. Eureka Fire Brick Wks., Pittsburgh, Pa.
H. E. Nold, Ohio State University, Columbus, Ohio.
Kenneth Seaver, Harbison Walker Refractories Co., Pittsburgh, Pa.

This committee is charged with the duty of keeping in touch with changes and improvements in the mining and preparation of the non-metallic minerals. While not excluding discussions of their use, as of concrete in highways, it is thought that, in the main, adequate facilities exist outside the Institute for papers on such subjects. The engineers in non-metal mines and works have most to gain by exchange of data regarding mining, crushing, sizing, and in general preparation, with other members of the Institute. Papers within the field of this committee are welcomed and engineers and others interested in these subjects will also be welcomed to membership in the Institute. The latter, while holding its standards high, is not an exclusive organization and has a place and class of membership for every one interested in its work.

Relation of Production of Cement to Capacity

	July 1928 Per Cent	July 1929 Per Cent	June 1929 Per Cent	May 1929 Per Cent	April 1929 Per Cent
The month	87.0	80.4	80.9	76.4	67.1
The 12 months ended	73.7	68.9	69.0	70.2	71.1

Production and stocks of clinker, by months, in 1928 and 1929. (In thousands of barrels)

Month	Production 1928	Production 1929	Stock end of month 1928	Stock end of month 1929	Month	Production 1928	Production 1929	Stock end of month 1928	Stock end of month 1929
January	11,839	12,041	9,672	9,642	July	15,981	15,120	11,707	11,607
February	11,363	11,255	12,237	12,436	August	16,202	.....	9,357	.....
March	12,501	12,450	14,463	14,948	September	15,909	.....	7,566	.....
April	13,844	14,166	15,002	15,472	October	15,782	.....	5,944	.....
May	16,025	15,445	14,329	14,910	November	14,930	.....	5,953	.....
June	15,940	15,283	12,944	13,573	December	13,426	.....	7,422	.....

Calcium Sulphate as a Retarder of Cement Clinker

U. S. Bureau of Mines Gives Results of Investigations

AN INVESTIGATION of the use of calcium sulphate for retarding the set of portland cement clinker has been conducted by the United States Bureau of Mines, Department of Commerce. A definite control of the time of set of portland cement is one of the problems which has been of primary interest to this important industry. The main purpose of the investigation was to develop a wider field of utilization for natural anhydrite.

While it is conceded that the grinding of the proper percentage of gypsum or plaster of paris with portland cement clinker will bring about a condition that leads to a normal setting cement, it has not been definitely established that natural anhydrite is equally efficient. Some of the gypsum deposits are contaminated by quantities of anhydrite mixed with the gypsum. Other deposits that are now relatively free from this difficulty may be troubled with it within the next generation. Since natural anhydrite, or gypsum which is mixed with an appreciable amount of anhydrite, is not suitable for the production of calcined gypsum products, a field for the utilization of this material would be of considerable value to the gypsum industry. Committee C-11 on gypsum, of the American Society for Testing Materials, recognized the importance of obtaining definite information on the utilization of anhydrite and requested the Nonmetallic Minerals Experiment Station of the Bureau of Mines to undertake a study of the action of anhydrite as a retarder for portland cement.

In September, 1925, the Bureau of Mines published Serial 2705, giving the results of an extensive series of tests on the retarder problem. This report indicates that mixtures of plaster of paris and anhydrite will generally retard the set of portland cement clinker, but that straight anhydrite is of questionable value. Twenty different samples of clinker were tested, but only one anhydrite was used in this first series of tests.

It is generally believed that the action of calcium sulphate as a retarder is closely related to its rate of solubility. The rate of solubility, in turn, depends upon the physical and chemical properties of the calcium sulphate, and as there is wide variation in the physical properties of the natural anhydrite obtained from different localities it seemed that some samples of anhydrite might react differently from others when used as retarders for cement clinker. Consequently, the question arose as to whether or not the results obtained with one sample of anhydrite would be greatly applicable to mill conditions, and Committee C-11 requested the Nonmetallic Minerals Experiment Station of the Bureau to extend its research to determine whether the type of anhydrite or its degree of fineness would affect its action as a retarder for portland cement.

Following this request, the Bureau of Mines undertook a series of tests with three additional samples of natural anhydrite and one of by-product material, the results of which tests may be summarized as follows:

Better and more uniform results were obtained on samples of cement when the retarder and clinker were ground together than when the clinker and retarder were ground separately. Consequently, the former results should be used primarily to compare the action of different retarders.

Cement retarded with gypsum is more plastic than that retarded with straight anhydrite, and cement retarded with plaster of paris is more plastic than that retarded with gypsum.

Cement retarded with straight anhydrite requires a higher percentage of sulphur trioxide than cement retarded with gypsum or plaster of paris. It would therefore not be possible to use anhydrite with samples of clinker that require the maximum percentage of sulphur trioxide as gypsum for proper retardation.

The action of plaster of paris differs from that of the other forms of calcium sulphate in that while it requires the smallest percentage of sulphur trioxide to produce a normal-setting cement larger percentages constitute an excess which produces a quick-setting material.

The tensile strength of cement that has been ground with gypsum in a ball mill of 200 pounds capacity is no higher than the strength of cement that has been ground with anhydrite in a similar manner. However, the calcination of the gypsum in the large tube mill changes its properties, so that its reaction when ground at the plant should be similar to that of plaster of paris mixed with clinker in the laboratory.

The tensile strength of cement retarded with plaster of paris is consistently higher than that of cement retarded with other forms of calcium sulphate. However, the amount of sulphur trioxide as plaster required for maximum strength may be in excess of the amount that will produce a normal-setting cement.

When anhydrite is mixed with equivalent proportions of gypsum and plaster of paris, a smaller amount of sulphur trioxide is required for normal set than when straight anhydrite is used. However, the required percentage of sulphur trioxide is slightly larger than that when straight gypsum or plaster of paris is used.

If properly retarded, the strength and plasticity of cement containing equivalent proportions of anhydrite and plaster of paris are practically the same as those of cement retarded with plaster of paris, while the quality of a normally retarded cement containing an equivalent mixture of gypsum and anhydrite is equal to that of cement retarded with straight gypsum. This conclusion is substantiated in mill practice, as many cement plants are using retarders that contain a considerable percentage of anhydrite and are obtaining satisfactory results. There has been a tendency, however, to assume that anhydrite is a successful retarder, while the information available shows only that mixed gypsum and anhydrite may be successfully utilized as a retarder. This conforms to the results obtained in the present investigation.

The results obtained with all three types of natural anhydrite tested were practically the same. The by-product anhydrite used in this series of tests was less effective than the natural anhydrite.

The relation between the action of the different forms and mixtures of calcium sulphate noted in this main series of tests is similar to that noted in the former investigation conducted by the Bureau of Mines in which 20 samples of cement clinker were tested.

More detailed information is given in Bureau of Mines Technical Paper 451, by Ernest E. Berger, which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a price of 10 cents.

Crosspatch John or "Concrete for Permanence"

By Jack Dempster

Old Crosspatch John of Gloomy Town
Sat murmurning in his old chair.
He wrinkled his forehead with many a frown
And rumpled his untidy hair.
He complained of the dust and swore at the heat,
Then out in his garden he went;
He directed his rage to a plant up the street
That was turning out Portland Cement.

"Those blank cement devils," he vented his spite,
"They make such a noise all the time;
They're pounding and grinding from morning till night
And their dust is a positive crime.
Their workers are dirty, their boss has no brains,
They're just a disgrace to the town;
They keep us awake with the shunting of trains.
O! I guess I'll go in and lie down."

His kitchen was cheerless, though John was not poor.
The old Crosspatch drove out the cat,
He locked all his windows and barred the back door,
And baited the trap for a rat.
And then, with more cursing and shaking his head,
He crept up the uneven stairs.
And threw himself down on his untidy bed,
Without ever thinking of prayers.

Now an angel of peace, from the Heavenly Sphere,
Came wandering along where John lay,
And he paused near the old man's couch, to hear
What the sleeping one had to say.
Old Crosspatch tossed restlessly over his bed,
And ceaselessly wagged his old tongue;
"What use is their product, I'd sure like to know!
They all really deserve to be hung!"

Now that angel of peace was a good, loyal soul,
And his heart was just filled with rage;
Yet his courtesy bade him respect to show
To the silvery crown of old age.
So he took Crosspatch by his old horny hand
And led him far into the night;
And only a cat on the fence round his land
Was a witness to that thrilling flight.

They crossed the rivers and valleys that lay
Between some mountains high,
'Til they came to the broad white Milky Way
That spanned the midnight sky.
There were twinkling stars and the moon was bright,
As it shone right overhead,
But old Crosspatch's heart was filled with fright
And a fearsome and nameless dread.

The angel gripped him with grasp that stung,
For his hand was as cold as snow.
"Look down!" he whispered, a gesture he flung,
"And behold what lies there below.
You are only a mortal man," said he,
"With the faults of your stupid kind.
Look over the edge and the Truth you will see,
To which you have long been blind."

So over the edge of the star-lit night
Old Crosspatch John looked down,
And he saw with Truth, in spite of his fright,
A bustling commercial town.
And out on the edge of that busy place—
Its Genius of Destiny—
Was a group of buildings, dusty and gray,
With a signboard "C. C. C."

He saw the men crush the clay and the stone
With giants whose maws never fill;
And he watched them perspiring with never a groan,
Confronting the heat of a kiln.
He marked them grinding the clinker to dust
To go into "Concrete that stays";
Then aroused, for the angel had said "You must
Go with me and see where it lays."

Then he saw a wild storm sweep over the town
With a deluge of wind and rain.
And he watched the tall buildings to see them fall down—
He thought they could never remain.
He looked at the highways, all glistening and wet,
Thinking traffic would slip to its doom.
The bridges o'er rivers, bv torrents were met
And the banshees shrieked in the gloom.

Then he turned and looked at his heavenly guide,
Whose countenance showed no fear;
"They're all built with 'Concrete that stands,'" he cried;
"That's just why I brought you out here.
The plant that you saw there is making cement—
The best of materials to-day—
Those highways and bridges cause no accident,
And those buildings are put there to stay."

"Look again at those toilers, they mind not the dust,
And their motto is 'Always take care';
Their watchword is 'Safety!' believe it they must,
And an accident rarely is there.
Concrete stands for Permanence, honest true work,
And it never will crumble with years.
Those men show a spirit that never will shirk
And they scorn the poor mortal who fears."

"Human they are, and perhaps full of faults,
Just even as you, my friend,
But each one is faithful to his own trust,
And faithful right unto the end.
However the world wags on and on,
And its buildings never will cease.
They must turn out cement by the thousand ton
In a stream that will always increase."

Old Crosspatch John sat up in his bed
For the sun had then risen high.
"I've had such a strange, wild dream," he said,
"Why, I fancied that I could fly.
I dreamed all about the cement that was made
And the way it was used outside.
Last night, I called them a worthless crowd.
To-day I admit that I lied!"

And the nicest old gent in the town today
Is John, who has now changed his name,
Since the night when he saw, far, far away,
The truth of the Portland Cement game.
And he thinks, as he waits for his last, long call,
Of that angel, whose mission was Peace,
And who showed that perhaps the best men of all
May be dusty and dirty with grease.

PERSONAL MENTION

George E. Pierson, formerly manager and sales manager of the Lone Star Cement Company, Indiana, Incorporated, has been elected vice-president of that company. He will relinquish his duties as sales manager but will continue as manager.

F. C. Hosimer has been transferred from the home office of the Wagner Electric Corporation to the Chicago branch sales office. He graduated from Purdue University in 1925, and entered the Wagner organization as a student engineer. Upon completion of the training course he became a sales correspondent, which position he filled until his recent transfer.

Benjamin Scott Wycoff, 65, died recently at his home in Bedford, Ind., after a brief acute illness following failing health. He was prominently identified with the local stone industry for 43 years. For 39 years he had served as foreman and superintendent of the Blue Hole quarry but recently has been superintendent of the P. M. I. B. quarry at Oolitic.

Colonel Henry Cockshutt, president of Cockshutt Plow and director of a number of Canadian companies, including the Canadian Pacific and Bank of Montreal, was elected a director of the Canada Gypsum and Alabastine Company, Limited.

Wallace S. Clark, manager of the cable division of the central station department of the General Electric Company, has been retired at his own request, and **F. H. Winkley** has been appointed manager of the consolidated lighting and cable division in the same department. Mr. Clark is being relieved of detail work and executive management so that he may devote more of his time to special negotiations and general consulting work.

George E. Learnard has been elected chairman of the board of International Tar and Chemical Corporation, succeeding **F. J. Lewis**, who continues as a director of International Combustion Engineering Corporation, the parent company.

Thomas J. Dee, vice-president of Davison Chemical Company, recently died.

William A. Sherman has been made director and president of Port Stockton Cement Company, which is to erect a plant to produce portland cement for the northern California markets.

Charles H. Segerstrom, president of the First National Bank, Sonora, California, has been elected director and treasurer of the new Port Stockton Cement Company.

Lynn Spinning, superintendent of the Interstate Sand and Gravel Company, killed himself by revolver shot, August 21, in his home at Covington, Indiana. The deed is attributed to sudden illness. He was 51 years of age, a veteran of the Spanish-American war.

Harry Guilford Jones, vice-president and secretary of Lexington Kaolin Company, while driving from his work at Edmund, S. C., was stricken and taken to New Brookland where he expired before medical aid could be secured. His home was in Columbia.

W. J. Cavanagh of New York City, practices an unique profession, typical in the modern trend of industries. He has specialized in the improvement of performance of all kinds and makes of crushers and other reduction equipment until he has acquired the sobriquet "Doctor."

Jack Dempster, Port Colborne, Ont., writer of a poem elsewhere in this issue of PIT AND QUARRY, has been described as follows by a friend:

"No title could fit Mr. Dempster's work at his own mill, his activities in the community, nor the place he has made for himself in the portland cement industry. While he is in charge of the stock room at mill No. 5 of the Canada Cement Company, he has organized, and is the moving spirit of the employees club which operates a comfortable club house and fosters social, athletic, and other activities in the town.

"He is head of the mill safety organization, handles many personnel and related matters, and edits a small weekly paper for the mill employees. He has made the cement mill employees organizations a great power for good in Port Colborne. Women connected with the families of the workers have an unusual organization which Mr. Dempster helps to maintain. He is a keen wit and exceptionally well informed. Mr. Dempster is generally regarded as one of the livest wires in the entire industry, and he has been placed on the program for the meeting of the Cement Section, National Safety Council at Chicago on October 1, to talk on his favorite subject, 'Putting Punch Into a Safety Campaign.'"

E. J. Schwanhausser, for the past two years assistant manager of the Harrison works of the Worthington Pump and Machinery Corporation, has been appointed manager of that company's Buffalo works. Only 35 years of age, Mr. Schwanhausser is one of the youngest executives in the Worthington organization whose employ he entered while yet a student at Stevens Institute of Technology. During the summers of 1912, 1913 and 1914 he was employed in the various shops and on the testing floors at Harrison.

Immediately upon his graduation in 1915, Mr. Schwanhausser was made test and erection engineer. In 1917 he was transferred to the condenser engineering department and in 1919 he was made machine shop equipment engineer. In 1920, Mr. Schwanhausser was promoted to the superintendency of the machine shops and in 1923 was appointed superintendent of the field erection department. He became engineering assistant to the manager in 1926, was made assistant to the manager in 1927 and, a few months later, was appointed assistant works manager.

Carey A. Jones, formerly Chicago branch manager for American-La-France commercial trucks in Chicago, has been appointed as special travelling representative for the newly merged LaFrance-Republic Sales Corporation, according to an announcement by F. D. Soper, vice president. Fred A. Myers, former Republic branch manager, assumes charge of the branch operation of the merged company in Chicago.

Ralph R. Rugheimer is now a member of the Atlanta branch sales office for the Wagner Electric Corporation. Mr. Rugheimer is well versed in the eletrical line, having spent quite a few years in the early days of his training on construction and central station work, also five and one-half years with the Westinghouse Company. He is a native of South Carolina, and a graduate of Newberry College in Electrical Engineering of that state.

Howard H. Leh has resigned as superintendent of the Lone Star Cement Co., a subsidiary of the International Cement Corporation, Nazareth, Pa., to accept an appointment as general manager of the Keystone Portland Cement Co., Bath, Pa.

TRAFFIC NEWS AND COMMENT

Cinders, Clay or Shale
(Haydite)

Trunk Line Association Bulletin 568 has set for hearing September 10 proposal to establish commodity rates per ton on clay or shale cinders, carloads, minimum weight 90 per cent of marked capacity of car from Jewettville, N. Y., as follows:

To—	Present Brick Rates	Proposed Rates
Albany, N. Y.	$3.70	$2.90
Baltimore, Md.	3.50	2.70
Connellsville, Pa.	2.75	2.20
Johnstown, Pa.	2.75	2.20
New York, N. Y.	4.10	3.30
Norfolk, Va.	4.20	3.35
Philadelphia, Pa.	3.70	2.90
Rochester, N. Y.	1.80	1.45
Washington, D. C.	3.50	2.70

The above are only representative destinations, and the proposal also involves rates to points ordinarily taking same rates or based upon arbitraries over basing points. This commodity is the comparatively new lightweight aggregate used in tiers of sand in concrete construction.

Cinders, Clay or Shale from Pittsburgh, Pa.
(Haydite)

A producer of this commodity located at Pittsburgh, Pa., has asked carriers to reduce his rates to various destinations in the States of New Jersey, Maryland, West Virginia and Pennsylvania. At the present time, the brick rates apply, but shipper feels he is entitled to lower rates. Present and proposed rates to representative consuming points are shown below:

To—	Present Rate	Proposed Rate
Lincoln, N. J.	$4.20	$3.35
Cumberland, Md.	2.40	1.90
Loraconing, Md.	2.40	1.90
Hampshire, W. Va.	3.30	2.65
Chiefton, W. Va.	2.40	1.90
Wyatt, W. Va.	2.40	1.90
Garrett, Pa.	2.40	1.90
Gray, Pa.	1.80	1.45
Meyersdale, Pa.	2.40	1.90

Trunk Line Association Docket M-1,209.

Cement, from Bessemer, New Castle, et al.

In Trunk Line Association Docket M-1,223 shippers seek readjustment of rates on cement from Bessemer, Wampum, New Castle, Walford, West Winfield, et al. to various stations on the Delaware & Northern R. R. To stations such as Harvard and Corbett a differential of 5c over East Branch, N. Y., is sought. To stations such as Colchester and Arkville, N. Y., a differential of 6c over East Branch is requested.

Soapstone Refuse

Trunk Line Association Docket No. 21,636 proposes per ton rates on soapstone refuse, crushed or ground, C. L., minimum weight 40,000 lb., from Esmont, Va., when from N. & A. R. R. as follows:

To—	Proposed	Present
Cleveland, O.	$3.83	$3.66
Detroit, Mich.	3.83	3.66
Cincinnati, O.	3.05	2.89
Chicago, Ill.	4.47	4.30
St. Louis, Mo.	5.30	5.13

The above are only representative destinations as many others are involved. The rate from Schuyler, Va., is proposed to be 27c per net ton higher than the proposed rate from Esmont. Reason: Proposed rates are comparable with rates from Vermont talc producing points.

New Rates Proposed on Slag

Interested shippers have asked the railroads to publish new rates on coal ashes, coal cinders, and slag, crude, granulated or commercial, crushed (the product of iron and steel furnaces) in bulk, in open top equipment from Sharpsville, Sharon, Ferrel, West Middlesex and Midland, Pa., to various Ohio destinations.

The following table illustrates proposed rates:

	From Pennsylvania				
To Ohio—	Sharpsville	Sharon	Farrell	West Middlesex	Midland
State Rood	$.90	$.90	$.90	$.90	$1.10
W. Farmington	1.00	1.00	1.00	1.00	1.10
Sundysburg	1.00	1.00	1.00	1.00	1.20
Meddlefield	1.00	1.00	1.00	1.00	1.20
Burton	1.00	1.00	1.00	1.00	1.20
East Claidon	1.00	1.00	1.00	1.00	1.20
Center Road	1.10	1.10	1.10	1.10	1.20
Chardon	1.10	1.10	1.10	1.10	1.20
Clarks	1.10	1.10	1.10	1.10	1.30
Concord	1.10	1.10	1.10	1.10	1.30
Painesville	1.10	1.10	1.10	1.10	1.30
West Fairport	1.20	1.20	1.20	1.20	1.30
Fairport Harbor	1.20	1.20	1.20	1.20	1.30

Mica

Trunk Line Association Docket No. 21,625 proposes change commodity description now reading "Mica, scrap, crude, or waste C. L. minimum weight as per Official Classification," to read "Mica, crude (mica ore) loose in bags, barrels or boxes, carload minimum weight 40,000 lb. Mica Scrap or Waste. (See note) in bags, barrels or boxes, or in bulk carload minimum weight 30,000 pounds" in connection with traffic between Virginia cities and eastern port cities.

Note—Ratings on scrap or waste mica, apply on mica which has value for grinding or pulverizing only. Reason: To publish uniform commodity description and at the same time revise description to conform with that in Consolidated Classification.

Lime and Limestone

Trunk Line Association Docket No. 21,631 proposes rates in cents per 100 lb. to following representative points on C. R. R. of N. J. from Jordanville, N. Y.

(A) Lime, C. L. minimum weight 40,000 lb.

(B) Limestone C. L., minimum weight 50,000 lb.

To	A	B
Jersey City, N. J.	$.17	$.16
Vulcanite, N. J.	.17	.16
Phillipsburg, N. J.	.15½	.14½
Catasauqua, Pa.	.15½	.14½
Copley Br. Jct., Pa.	.13½	.13
Tannery, Pa.	.13½	.13
Upper Lehigh Jct., Pa.	.12½	.12
Pond Creek Jct., Pa.	.13½	.13
Upper Lehigh, Pa.	.13½	.13
White Haven, Pa.	.12	.11½
Lee, Pa.	.12	.11½

Reason: Proposed rates are comparable with those now published from Jordanville to L. V. R. R. stations.

Firestone

Central Freight Association Docket No. 22,561 proposes commodity rates on firestone C. L. minimum weight 60,000 lb. from New Castle and Eastbrook, Pa., to representative destinations as follows:

Present rates in cents for 100 lb.

Proposed rates in dollar per ton at 2,000 lb.

To—	Present Rates New Castle	Present Rates Eastbrook	Proposed Rates
Salem, O.	$.13	$.13½	$1.20
Newark, O.	.18	.18	1.95
New Castle, Ind.	.23½	.23½	2.75
Benton Harbor, Mich.	.25	.25	3.25
La Porte, Ind.	.24½	.24½	3.25
Springfield, Ill.	.29	.29	4.05
Madison, Wis.	.40½	.40½	4.60

Silica Sand

Western Trunk Line Docket No. 7,012 proposes establishment of rates on sand, silica, crude and processed, C. L. from Ottawa to all points in Central Freight Association Territory on the same basis as now applies to Indiana, Michigan and Wisconsin, which were prescribed in I. C. C. Docket No. 17,817 Sub. 1.

Talc By-Products

Carriers serving talc districts such as Bethel, Braintree, East Granville, Middlesex and Waterbury, Vt., propose readjustment of rates on roofing and waste talc to points in western New York, western Pennsylvania, Ohio, Indiana, Illinois and Michigan (Southern Peninsula), in line with the existing rates from Schuyler, Va. It is stated that this readjustment of rates is necessary to enable producers in the districts mentioned to dispose of their waste materials. (New England Freight Association Dcoket No. 17,591.)

New England Carriers Propose New Basis

In New England Freight Association Docket 610-3 the carriers operating in the New England states propose to establish a uniform basis for rates on chips, granite or stone; gravel, crushed or screened; gravel, run of bank; grout, granite or stone, sand, common building; stone, broken or crushed; stone, crushed, when coated with tar, asphalt, oil or any bituminous binder; in bulk in open cars for joint hauls.

The object of the new scale is to afford a basis for determining rates in the future on the articles mentioned for joint haul movements, subject, of course, to specific approval of the interested lines thereby permitting publication of rates without filing freight rate proposals.

The scale is as follows:

Distances—	Rates in Cents Per Ton
Not over 20 miles	105
Not over 30 miles	110
Not over 40 miles	115
Not over 50 miles	120
Not over 60 miles	125
Not over 70 miles	130
Not over 80 miles	135
Not over 90 miles	140
Not over 100 miles	145
Not over 110 miles	150
Not over 120 miles	155
Not over 135 miles	160
Not over 150 miles	165
Not over 165 miles	170
Not over 180 miles	175
Not over 200 miles	180
Over 200 miles	185

The rates will not apply on agricultural limestone, poultry grits, mica-crystal grits, fluxing stone, dolomite, limestone or stone dust, no scale being proposed at present on those commodities.

Reduction Sought in Rate on Scrap Marble from Phenix, Mo., to Grand Island, Neb.

A producer of scrap marble at Phenix, Mo., has asked the carriers to publish a rate of $2.60 per ton to Grand Island, Neb., in order to place him on parity with producers at Carthage, Mo. It is stated that this rock scrap marble is used for sugar-making purposes.

Southwestern Freight Bureau Docket 18,203 relates to this subject.

Sulphate of Lime

Eastern carriers have announced that they are giving consideration to proposition to cancel existing commodity rates on sulphate of lime between points in the states of Pennsylvania, New York, New Jersey, Maryland and Delaware, also from points in those states to points in New England.

They are considering also cancellation of import rates on this commodity to the same destinations.

(Trunk Line Association Docket M-1,228.)

MANUFACTURERS' PUBLICATIONS

Copies of any of these publications will be sent free to readers who address their requests to the Editor, PIT AND QUARRY.

Air Tools and Compressors

Power—Gardner-Denver Air Tools and Portable Air Compressors. 8 p., 14 ill. Describes and illustrates heavy-duty hand tools and air compressors mounted on trailers and motor trucks.

Cranes

Speeder Simplicity. 8 p., 7 ill. Decribes and illustrates the improved Model B-3 Speeder convertible crane, shovel, dragline, clamshell, pullshovel and skimmer. Typical uses are illustrated.

Cranes, Truck-Mounted

Crane Service News. 4 p., 30 ill., Universal, Aug.-Sept., 1929. Illustrates various applications.

Universal Cranes for Steel Erecting, Stone Setting, Rigging Work. 12 p., 55 ill., Universal, Bulletin 47. Describes and illustrates typical uses of truck-mounted cranes using Waukesha motors.

Diesel Engines

"Hints for Diesel Operators." 2 p., 2 ill., *The P & H Crowd,* Sept.-Oct., 1929. Contains practical suggestions on smoking, oil consumption, impure air intake, and cooling water.

Efficiency

Thinking Through. 12 p., Sturtevant, Experience No. 3. Points out that the governing principle in solving production difficulties is commercial efficiency of the solution and not mechanical efficiency and that the chief end of business is profit, not operation.

Generators

Type ES Engine-Driven Alternating-Current Synchronous Generators. 4 p., 7 ill., Westinghouse, L. 20355-A (rev. ed.). Describes generators designed for direct connection to steam, gas or oil engines. The illustrations show mechanical details and typical installations.

Investigation

Check Your Conclusions. 12 p., Sturtevant, Experience No. 5. Deals with the necessity for careful study of operating problems before selecting methods and equipment.

Locomotive Cranes

15-Ton, 20-Ton Locomotive Cranes; Gasoline, Electric, Diesel; Thew-Lorain. 16 p., 31 ill., Thew, Form 426. Discusses the cost and operating advantages of the different types and illustrates typical applications.

Lubrication

"How Whiting Corporation Solves an Important Lubricating Problem." 2 p., 5 ill., *Alemite Industrial Lubrication,* Aug., 1929. Discusses pressure lubrication in crane construction.

Motor-Generator Sets

Synchronous Motor Generators. 4 p., 10 ill., Westinghouse, L. 3746-E. Describes and illustrates applications and details of construction of 2-unit and 3-unit outfits for 25-, 50-, and 60-cycle service.

Production Costs

Cost-Cutting or Profitless Prosperity? 12 p., Sturtevant, Experience No. 1. Discusses improved processes and products, standardization, new-process equipment, shortening production time, labor relations, and the elimination of waste in their effects on production costs.

Purchasing

Buymanship. 12 p., Sturtevant, Experience No. 2. Gives practical hints to aid in the selection and purchase of machine equipment, with special reference to screening.

Refractories

Already Over 500 Days Longer Average Hot-Zone Lining Life... 2 p., 1 ill., Arcofrax. Data on five Arcofrax-lined kilns in a prominent cement plant.

Road-Building Machinery

Warco (H-P) Road-Building Machinery. 32 p., 56 ill., Riddell, Catalogue 2901. Describes and illustrates various types and sizes of power graders, snow plows, scoops, crawlers, and road rollers.

Sand Pumps

Wilfley Centrifugal Sand Pump (Patented). 44 p., 25 ill., Wilfley, Catalogue 7. Describes and illustrates various applications and details of the Model C, and gives operating data covering its use in handling mill, table and jig tailing, concentrates, thickener discharge, muddy water, sand and gravel, silica sand, granulated slag, flue dust, cement and clay slurry, and milk of lime.

Waste Elimination

Profit from Waste Elimination. 13 p., Sturtevant, Experience No. 4. Discusses the various forms of waste —time, labor, material, power, and production.

Wire Rope

The Wire Rope Users' Handbook—Construction and Industrial Section. 108 p., 75 ill., American Cable. Discusses the selection and care of wire rope for various purposes and gives data on strength, safe loads, sheave design, bending stresses, stretch, elastic limit, deflection, seizing, socketing, splicing, lubrication, alignment, etc.

FINANCIAL NEWS
CORPORATE & BUSINESS

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff or of the writer, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, for which no responsibility in any way is to attach to this magazine or to any of its staff.

Recapitalization Plan of General Asphalt

A special report from the Philadelphia Financial Journal states that General Asphalt Company has called its entire issue of 6 per cent convertible bonds for redemption October 1, and the entire issue of convertible preferred for redemption December 23. Funds for this redemption will be provided by issuance of rights, to common stockholders of record October 23, to subscribe to additional common stock at $50 a share in the ratio of one new share to every three old shares held. The rights will expire November 27.

A special meeting of the stockholders will be called, probably on September 19, to vote on the proposed recapitalization plan. At this meeting stockholders will be asked to authorize 1,000,000 shares of new no-par common stock. The present common is $100 par.

The company plans to segregate, into a new corporation, its oil interests in western Venezuela. The offering of additional common stock will be underwritten by Drexel and Company.

At the beginning of this year General Asphalt had outstanding $4,205,800 of 6 per cent bonds, due in 1939, and callable at 105 up to October 1, 1929. These bonds are convertible par for par into common stock, or one share of common for every $100 of bonds.

The company had 66,082 shares of $5 preferred stock, callable at 110 on 90 days' notice, convertible one share of preferred for one and one-half shares of common. Considering the common stock price basis of 90, this makes the value of the preferred for conversion at least 135, so that the preferred undoubtedly will be converted before the retirement date on December 23, 1929.

Conversion of all preferred would amount to 99,123 shares of common, and the bonds to 42,058 shares of common.

However, it is unlikely that the bonds will be converted with the common stock selling currently around 90. Sufficient funds would be derived from the sale of about 84,000 common shares at $50 a share to provide for the retirement of the bonds. There are now 210,614 shares of common outstanding.

Drexel and Company which is underwriting the additional common have also guaranteed the conversion of the preferred stock. They themselves will convert any preferred stock which is deposited by December 23 under redemption notice. In other words if any individual stockholder fails to convert his preferred, the bankers will convert it, providing a sum of $110 a share to pay off each share of preferred be deposited for redemption and the bankers receive one and one-half shares of common stock for each share of preferred stock whose conversion it guarantees. By this arrangement Drexel and Company provide any money required to redeem any preferred stock which has not been converted into common.

Monolith Portland Figures Higher Than Last Year

A recent report issued by Coy Burnett, president of the Monolith Portland Cement Company, for the first half of 1929 showed net profits available for dividends of $307,732, equal, after preferred dividend requirements of $60,000, to $1.10 a share on 225,000 common shares outstanding, or at the annual rate of $2.20 a share on the common stock.

The report, Mr. Burnett stated, does not cover the operations of the Monolith Midwest Cement Company, which started its plant this summer. This subsidiary of which Monolith Portland owns all of the common stock, recently obtained a large contract for highway and road paving in Nebraska and has sufficient orders booked for its entire production for the balance of the year, according to Mr. Burnett. It is producing 65,000 barrels of cement monthly.

The half-year showing of Monolith Portland Cement, exclusive of the Midwest Company, compares favorably with the earnings for the entire year of 1928, when net profits available for dividends totaled $375,780.20, equal after preferred dividends to $1.71 a share on 150,000 common shares outstanding.

Net sales during the first six months of this year amounted to $1,534,985. Gross profits on sales were $495,217 after deduction of $915,621 for labor, supplies, royalties, and plant expenses, and after allowance of $124,146 for depreciation and amortization of leasehold on limestone deposits, based on appraised values.

Net profits of operations were $286,474 after selling and administrative expenses of $208,146; while interest received and other income totaled $26,309 net, making profits, before interest charges and Federal income tax, $312,784.

Deduction of $18,333 for interest charges and amortization of bond discount and expenses, and of $34,192 for Federal income tax provision, left a balance of $260,258 to which was added back $47,473 for depreciation and depletion charges on excess of appraised values of plant, equipment and limestone deposits over actual cost values, bringing net profits available for dividends to $307,732.

New Corporations

Sirra Gypsum Products Co., Ltd., c/o Corp. Trust Co., Wilmington, Del. $250,000; 5,000 shares com.

J. O. Gilman Granite Co., c/o Bruce McClelland, Jr., 415 Southwest Bank Bldg., Oklahoma City, Okla. To operate in Kansas.

Virginia-Carolina Granite Co., Inc., Danville, Va. $100,000. T. S. Williamson, Pres.; T. S. Williamson, Jr.

Natural Lannon Stone Corp., Milwaukee, Wis. $50,000. A. J. Hochuli, 275 26th St.; E. Wiegert, M. M. Gueldner.

Schoenfeld Quarries, Inc., San Antonio, Tex. $175,000. Chas. M. Schoenfeld, L. H. Haring, E. G. Hendrix.

Kalbfleisch Corp., 200 Fifth Ave., New York City. 10,000 shares n.p.v. To mine bauxite at Kalamazoo, Mich. J. O. Hammitt, E. V. O'Daniel, G. R. Martin, all of New York City.

Kennerlyte Quarries, Inc. J. W. Brawley, Pres., Thomasville, N. C. $100,000. D. L. Kennerly, Greensboro, N. C. To produce flagstone of slate formation.

Mica Products Corp., Norfolk, Va. $25,000 to $100,000. H. C. Field, Pres., Martinsville, Va.; M. G. Nusbaum, V. P.; J. B. Hecht, Secy.-Treas., Norfolk. To operate 37 mining properties in Virginia and North Carolina producing mica and feldspar.

Oranville Wash Sand & Gravel Co., Milwaukee, Wis. 100 shares, $100 each. Peter E. Fichaux, John C. Fellenz, Jr.

Jonesville Gravel Corp., Ft. Wayne, Ind.

Arpe Sand & Gravel Co., Milwaukee, Wis. 150 shares, $100 each. Peter F. Leuch, Louis E. Fichaux, John Fellenz, Jr.

Newark Sand & Gravel Co., Newark, Ohio. $25,000.

California Nevada Sierre Madre Co., Reno, Nev. $1,000,000. To produce sand and gravel. Office will be established in San Francisco, Calif.

Mica Rock Asphalt Mining Co., Kansas City, Mo. 500 shares n.p.v. To mine and mill rock asphalt. D. V. Snowgoose, Arcadia, Kans.; Fritz Muder, M. R. Murray, Wm. Hicks, Sam Feller, all of Kansas City, Mo. Sam Feller, attorney, 1003 Scarritt Bldg., Kansas City, Mo.

Stauffer Rock Co., Joplin, Mo. 50 shares, $100 each. John L. Stauffer, Geo. W. Potter. To operate rock crushing and handling plants.

Tricosal Corp. of America, Seattle, Wash. E. G. Riebe, Pres.; H. R. Lawson, V. P.-Treas.; Edgar Anderson, Secy.; J. G. Falk, R. L. Robinson, R. D. Brown, L. R. Moses, F. G. McDonald, directors, all of Seattle. Will manufacture and sell a material for the waterproofing and quick drying of cement.

Standard Lime Co., Ltd., Paris, Ont., Can. 10,000 shares n.p.v.

Western Gypsum Products, Ltd., Winnipeg, Man., Can. 5,000 shares pfd.; 10,000 shares com, n.p.v..

Keystone Terrazzo & Tile Co., Harrisburg, Pa. $5,000. To quarry marble, slate, etc. R. V. Douglass, attorney, 222 Market St.; John Pierce and Dante Malpezzi, 132 Bossler Ave., Lemoyne, Pa.

Gropper Onyx Marble Co., c/o P. E. Snemel, 277 Broadway, New York City. 200 shares com.

United Marble Co., Inc., Philadelphia, Pa. $30,000. Harry Donnelly, attorney, 706 Liberty Trust Bldg. Anthony A. Poman, Treas., 15 W. Abington Ave.; J. Harold Hines, 5845 N. 7th St.

Depaoli del Turco Pofcato Corp., c/o Canter & Phillips, 15 Whitehall St., New York City. $285,000 pfd.; 3,000 shares com. To quarry marble.

Pacific Coast Aggregates, Inc.

This huge new company which is said to be the largest sand, rock and gravel company in the world, with resources of more than $20,000,000 and operating twenty producing plants, as well as twenty-five distributing plants, has just published its first balance sheet as of July 1, 1929 (after giving effect to its proposed financing acquisition of properties). It is as follows:

Assets	
Land, buildings, equipment, etc.	$13,473,879
Contracts, etc.	1
Investments	5,216,813
Unamortized bond, disc., expend.	712,000
Current Assets	
Cash	$ 901,150
Inventories	267,525
Total Current Assets	$ 1,168,675
Total Assets	$20,571,368
Liabilities	
*Capital stock	$14,725,018
Funded Debt	5,500,000
Deferred Liabilities	180,000
Current Liabilities	
Accounts payable	166,350
Total Current Liabilities	$ 166,350
Total Liabilities	$20,571,368
†Net Working Capital	$ 1,002,325

* Represented by 154,993 shares of preferred and 219,500 shares of common.

† Based on current assets and current liabilities as above.

The area that this company will serve contains one-half of the population of California and represents one of the fastest growing sections in the United States.

A recent statement that appeared in the Daily Commercial News of San Francisco stated that it was understood that the Natomas Company had leased its Northern California crushing properties to the Pacific Coast Aggregates. It was said that the lease had been effected at the rate of $10,000 a month and that, with the leases, the Pacific Coast Aggregates had been given the option for the purchase of the properties for approximately $2,000,000.

Lehigh Portland Cement Earnings Up

Lehigh Portland Cement Co. has just reported its earnings for the fiscal year ending May 31, 1929. The report shows that the company earned $4,108,567, or $5.75 per common share in that fiscal year as compared with $3,955,041 or $5.28 a share in the corresponding previous year. Its ability to show increasing profits even though the gain is small, is testimony of its strong financial and trade position, for the industry has been, and still is in an unsettled condition caused by over-production and competition. A decline in building construction in the first six months of this year added confusion to the situation.

Construction contracts awarded in July, however, were 12 per cent above the total for July, 1928, 20 per cent above June, 1929, and the second largest total on record. It may be that builders, who delayed construction in anticipation of lower credit charges, have decided to wait no longer. This company is said to be benefiting especially from building activity in the Metropolitan district, including subway work and a $45,000,000 water-supply tunnel.

Lehigh Portland produces approximately 12 per cent of this country's total cement output and has plants in ten states. It also owns large reserves of limestone and other mineral deposits. Its financial position is strong, cash items alone amounting to more than $12,500,000 as against only $2,310,467 current liabilities. Dividends on the common, which is selling around 47, are at the annual rate of $2.50 per share. In addition to the 450,348 common shares, there are 216,967 preferred shares outstanding, paid as a stock dividend early in 1928.

Decline in Cement Shares

The Preferred and Common stocks of a group of representative cement companies declined to new low prices for the year in the last week due to cuts in the price of that commodity. Little improvement can reasonably be anticipated this year due to the continuance of over-production and acute competition. Mills have been forced to close in many districts because of highly unprofitable local conditions.

Pacific Coast Aggregates to Offer Bonds

Public offerings of two security issues totaling $5,500,000 of the Pacific Coast Aggregates, Inc., newly formed sand, rock and gravel company, with holdings in central and northern California, valued at approximately $20,000,000, will be made shortly by a group of California and Eastern bankers.

The larger issue consists of $4,000,000 worth of first mortgage 6½ per cent sinking-fund gold bonds; and the other issue consists of $1,500,000 worth of ten-year sinking-fund 7 per cent convertible gold debentures.

Canada Gypsum Split-up

Stockholders of Canada Gypsum and Alabastine, Limited, have approved the proposal of the directors to split the authorized stock four for one. The authorized capitalization is 500,000 common shares. July sales increased 40 per cent over July, 1928, according to R. E. Haire, president, and for the first seven months of 1929 an increase of 30 per cent was shown.

Directors will meet on September 5 to consider a dividend basis for the new stock. Henry Cockshutt, president of Cockshutt Plow Company, was elected a director of the company.

Warner Stock Admitted To Philadelphia Trading

Common stock of the Warner Company, prominent Philadelphia corporation which produces and sells gravel, sand and similar building materials, was admitted to trading in the unlisted department of the Philadelphia Stock Exchange last month. The common stock was already listed on the New York Curb market.

This arrangement for the unlisted trading will be temporary as it is planned to admit both the common and preferred shares, as well as the company's bonds, to the regular list in the near future.

The Warner Company was organized in 1929 to acquire the business and practically all of the assets of the Charles Warner Company and the Van Sciver Corporation. The Charles Warner Company was incorporated in 1885 and is a direct successor to a partnership established at Wilmington, Delaware, in 1794.

The company has been expanding rapidly. It acquired the Penn Sand and Gravel Company in 1924; the American Lime and Stone Company in 1925; the Henry E. Strathmann, Inc., in 1926; and, in 1927, it absorbed the West Jersey Sand and Gravel Company in which it had a substantial stock interest. Merger with the Van Sciver Corporation under the new corporate title took place early this year.

The company owns 2,400 acres of land at Tullytown, near Bristol, which is estimated to contain 65,000,000 tons of marketable materials.

There are outstanding 203,000 common shares, of a total of 350,000 authorized. The common stock is selling around 45.

Diamond Crystal Salt Company Acquired

General Foods Corporation will shortly issue 100,000 shares of its common stock for all outstanding common stock of Diamond Crystal Salt Company.

Products of Diamond Crystal Salt Company, incorporated in 1888 in Michigan, are nationally known as "Diamond Crystal" and "Shaker Salt." It is the only salt manufactured under the Alberger patented process, which patents are owned by the company. This process mechanically removes from the salt the natural impurities without the aid of chemicals.

In addition to its large wholesale trade of table salt, Diamond carries on an extensive business with creameries, bakeries, meat packers, dairies, cheese manufacturers, etc.; sales offices are maintained in New York, Chicago, Boston, Detroit, Atlanta, Minneapolis, San Francisco, Dallas, Kansas City and Toronto.

The plant located at St. Clair, Michigan, covers a ground area of 600,000 sq. ft. and has a maximum capacity of 5,000 bbl. of salt daily, with a normal output of about 4,250 bbl. The salt is produced from twelve wells and additional property owned by the company practically insures an inexhaustible supply.

Diamond Crystal owns or controls the entire stock of the Western Salt Company.

The company reported for five months ended May 31, net profit, after charges and taxes, of $391,257. This is compared with net profit, after charges and taxes, of $379,629 for the entire year of 1928.

Rock Asphalt Receives Large Foreign Order

A dispatch from Unalde, Texas, states that the Standard Rock Asphalt Company, which started operations near there on August 1, has received an order from the government of Italy for 1,000,000 tons of rock asphalt to be delivered at the rate of 100,000 tons a year. The material will be used for construction of highways in Italy.

Holdings of the company embrace a rock asphalt deposit which covers 4,562 acres and is estimated to contain approximately 77,000,000 tons of the material. The actual product under immediate operation covers 130 acres. The rock asphalt averages 2½ ft. under the surface, some places being only 6 in. deep. The overburden, as this is called, is said to be the most favorable to easy mining in the country.

Canadian Cement Company Sued for Royalties

An injunction to restrain the Belanger Cement Works, Limited, from quarrying rock on the premises owned by Mrs. Z. Pesant, has been instituted by Madam Pesant in the Practice Court at Montreal, Quebec. The petition filed before Justice Archambeault claiming royalties owing on the rock quarried have not been paid to her and an action has been taken in the courts to recover the unpaid royalties.

According to the petition, the plaintiff owns 67 lots in Rosemount and her husband, now deceased, entered into an agreement with the cement company to exploit the property and a royalty of nine cents per ton was to be paid on all rock quarried. This agreement became effective on April 11, 1927, it is claimed, and rock has been quarried since that date to August 11, 1929. During that period, the royalty payments amounted to $7,722, it is contended. The petition was received and an order issued allowing the defendant company to contest the proceeding by writing.

CURRENT DIVIDENDS

COMPANY	CLASS OF STOCK	DIVIDEND RATE	HOLDERS OF RECORD	PAYABLE
Alpha Portland Cement	Preferred	1¾% Qr.	Aug. 31	Sept. 14
Atlas Portland Cement	Common	$.50 Qr.	Aug. 16	Sept. 3
Canada Cement	6½% Pfd.	1½% Qr.	Aug. 31	Sept. 30
Canada Paving and Supply	1st Pfd.	1¾% Qr.	Aug. 20	Sept. 1
Cleveland Quarries	.....	$.50 Qr.	Aug. 15	Sept. 1
Cleveland Quarries	.....	$.25 extra	Aug. 15	Sept. 1
General Asphalt	Preferred	1¼% Qr.	Aug. 14	Sept. 3
Indiana Limestone	Preferred	1¾% Qr.	Aug. 20	Sept. 1
Illinois Brick	.....	$.60 Qr.	Oct. 3	Oct. 15
Johns Manville Corp.	Common	$.75 Qr.	Sept. 24	Oct. 15
Johns Manville Corp.	Preferred	1¾% Qr.	Sept. 10	Oct. 1
Kentucky Rock Asphalt	Preferred	1¾% Qr.	Aug. 15	Sept. 3
Lehigh Portland Cement	Preferred	1¾% Qr.	Sept. 14	Oct. 1
Material Service Corp.	.....	$.50 Qr.	Aug. 15	Sept. 1
Metropolitan Paving Brick	Preferred	1¾% Qr.	Sept. 15	Oct. 1
Metropolitan Paving Brick	Common	$.50 Qr.	Aug. 15	Sept. 1
National Brick Co. of Laprarie	6% Pfd.	$.75 Qr.	Aug. 31	Sept. 16
Okonite Co.	Preferred	1¾% Qr.	Aug. 20	Sept. 3
Penn Dixie Cement	Preferred	1¾% Qr.	Aug. 31	Sept. 15
Super Portland Cement	Class A	$.27½ Mo.	Aug. 23	Sept. 1
Texas Gulf Sulphur	(No Par)	$1.00 Qr.	Sept. 2	Sept. 16
United States Gypsum Co.	Preferred	1¾% Qr.	Sept. 14	Sept. 30
United States Gypsum Co.	Common	$.40 Qr.	Sept. 14	Sept. 30
Virginia Carolina Chem.	Prior Pfd.	1¾% Qr.	Aug. 17	Sept. 1
Worcester Salt Co.	Common	1¼% Qr.	Sept. 24	Sept. 29

INSURANCE PROBLEMS DISCUSSED

How Employee Insurance Benefits Operators

Welfare work among employees is an accepted policy of American business. Except in a few cases of organized labor where the union insists on administering all benefits, employers are doing extra things either for pure humanitarian reasons or to hold the good will of their workers. In all schemes of employee welfare, insurance of some sort plays a part, sometimes covering death, sometimes illness or accident, or a pension for old age.

The company treasurer was originally the manager of the welfare insurance, deducting monthly assessments from the wages and paying out the benefits at his own discretion. This simple system has practically broken down. It is so much subject to the management's whim that it does not hold the full confidence of the men. And whenever a heavy run of losses drains the surplus of the welfare association, the private plan usually becomes insolvent and disappears. Insurance companies came into the picture because, with their great resources, they are able to stand a temporarily bad loss experience and also to devise policy forms and rates which are equitable.

Life insurance for employees is carried in an amount of millions of dollars because it is such a valuable medium of welfare work. In the first place, when an improvident worker dies, his firm will feel morally bound to make a contribution toward his funeral expenses and the next month's rent and grocery bill of his widow. The moral obligation to help an employee's family through a crisis is a commendable public spirit, and the action of the "boss" at such times is thoroughly discussed and judged by the other members of the organization. But one such experience usually costs more than an insurance premium covering the whole working force. If a deceased employee is covered by insurance, the proceeds of his policy will be turned over to his family and his firm need pay nothing more. A successful manager likes to budget all of his possible expenses. An insurance plan permits him to fix in advance the cost of all his welfare work, and to standardize his philanthropy so that he is not subject to expensive spasmodic bursts of emotion.

Effect on Wives

What effect welfare work will have on the people in a worker's home is an aspect that needs careful study. A contented man will turn out more production than a grumbler or a man who is wishing for another job. It is the wife or mother at home who largely controls a man's contentment. An insurance policy extends your friendly feelings and protection to the wife. It gives her a direct interest in keeping her husband at work and makes her a booster for your firm.

"Group life," as this form of insurance is called, can be made to fit any size of producing or manufacturing firm. While organizations of fifty or more get a slight advantage in rates, a group of twenty-five or even ten can obtain wholesale arrangements which are quite advantageous.

Next month, October, is the time most desirable for making a study of all your welfare problems and especially of insurance. There is an extra feeling of sentiment even in business houses around the holiday season, and any plan of employee betterment will get a more auspicious welcome by the men if it is inaugurated as a Christmas present. Since three or four weeks are necessary for the printing of supplies and other mechanical details before an insurance scheme can be set in operation, you should do your study and investigating of this subject during the early fall.

Employees Share Cost

By comparison with other forms of bonus a life insurance policy makes a fine showing for the money invested, because the beneficiaries think of it in terms of the face value of the policy and not of the few dollars of annual premium. When this plan was first introduced it was the practice for the employer to stand the entire cost, and some firms still continue to foot the bill. It is generally found, however, that employees look on this method as paternalistic and wonder whether there is some joker in the management's apparently good intentions. A thing that costs nothing is seldom valued as highly as something that calls for a personal sacrifice. Therefore group life insurance has become a great cooperative movement between workers and employers. A monthly charge (usually sixty cents a month) is deducted from each employee's pay envelope. To this the management adds from one to five dollars a year, so that all parties get the general benefits, while the burden of cost does not fall heavily on anyone.

The policy form used is simple and is fitted especially to industrial needs. The amount carried on each employee is never less than $500 and usually is not more than $2,000. Any amount within these limits is considerably more than a workman is likely to carry on his own initiative, and yet it is certainly not greater than his direct obligation to his family. Millions of industrial workers in the United States are carrying small personal policies with a weekly or monthly premium running from two to four times the rates for group life insurance; so the employer who puts a group policy within the reach of his men is giving them something which they cannot buy otherwise.

The amount of insurance must be uniform for all persons within each class of employees. You can give varying amounts, if you wish, to executives, foremen, clerks, chauffeurs, or any other distinct class; but you cannot, for example, give a larger amount of protection to one bookkeeper than to another.

Monthly Income

When an employee dies the proceeds of his policy may be paid directly to his family in a lump sum. But it is often better protection for a widow if some of the money be held back so that it cannot be dissipated for an elaborate funeral or other luxury. On order of the employer, the insurance company will be willing to make the payments to the widow in monthly installments for a year, so that she will have a regular income through her period of readjustment. Each employee, of course, has an unrestricted right to choose the beneficiary under his own policy and is just as free in directing the distribution of proceeds as if he were buying an individual policy.

Besides the death payment, a group policy will pay a small monthly allowance for total disability. This is a particularly valuable help to industrial workers, since they seldom have a large enough reserve fund to meet the living expenses during a long siege of illness.

[A discussion of rates and of plans for disability and pension insurance will follow in the next issue.—Editor.]

LEGAL INFORMATION FOR OPERATORS

Seller of Equipment Liable in Damages

Generally speaking, a seller of equipment is liable for full damages caused another who was induced by fraud to enter into the contract of sale. This point of the law was considered by the Court in Meyer & Greenwald Const. Co. v. Salina Gravel Co., 277 Pac. 274.

The facts of this case are that a seller sold to a stone and gravel company a steam shovel. The gravel company paid $1,000 down, paid the freight amounting to $346, and gave its notes for the balance due.

After the gravel company had endeavored to operate the shovel, its officials complained that the machinery was worn out, and sued the seller for cancellation of its notes, repayment of the down payment, the freight charges and loss of time and expense in endeavoring to operate the shovel.

During the trial the gravel company introduced testimony proving that for the purpose of inducing the sale the seller had written letters stating that the shovel was in excellent condition. In view of these facts the lower Court held the seller liable and the higher Court indicated its approval of the decision, stating important law, as follows:

"The amount of damage in such case is defined to be the excess, of the value which the property would have had at the time to which the warranty referred, if it had been complied with, over its actual value at that time, plus fair compensation for the loss incurred by an effort in good faith to use it [the property] for such purpose. . . . If the contract were induced by fraudulent representations, and if the defendant (buyer) without waiving and within a reasonable time after discovery of the imposition, offered to rescind, the defendant (gravel company) was entitled to recover, and entitled to have his notes canceled, to recover his down payment, and also the amount paid for freight."

Quarry Owner Not Liable For Injury Caused By Exploding Caps

The details of the recent case of Kennedy v. Independent Quarry & Construction Co., 291 S. W. 475, is important for the reason that the liability of a quarry owner who fails to exercise care in storing explosives is thoroughly discussed.

The facts of the case are that the Independent Quarry & Construction Company owned and operated a quarry which was located adjacent to another quarry, which, however, had been abandoned for several years.

One Sunday morning a man named Kauffman went swimming in the pool in the quarry and when dressing in a nearby shed he observed a tin box lying on the rafters. He opened the box and lit the fuse. The cap immediately exploded, causing severe injuries to his eyes which made him practically blind. He sued the Independent Quarry & Construction Company for damages as a result of the injuries sustained, contending that the latter was negligent in leaving such dangerous explosives within access of persons who came upon the quarry premises.

The Court held the Independent Quarry Company not liable, and explained the law as follows:

"It may be stated as a general principle of law that one who has in his possession or under his control an instrumentality dangerous in character, is bound to take exceptional precautions to prevent an injury being done thereby. . . . The plaintiff (Kauffman) had lived for a long time at no great distance from the quarry, and knew that blasting operations had been carried on in it."

Employer Must Supply Efficient Tools

On various occasions important litigations have involved the degree of care required of an employer to furnish tools which are safe for the employes: In the case of Watson v. Carthage Marble & White Lime Co., 290 S. W. 649, several important points of the law were decided.

In this case the owner of a plant removed stone from a quarry to a mill, where the stone was cut or sawed into the dimensions desired. Long thin saws without the teeth were used to cut the stone, and several saws were used at the same time upon the same stone. These saws were operated by machinery, and had a hole in each end in which a dog was bolted by means of wedge-shaped steel keys.

When it was necessary to change saws the foreman would put the keys in the dog opening at one end and the workman put them in at the other, and upon a signal from the foreman the workman would drive in the key at his end.

One day a workman placed a key in the opening in the dog and, upon receiving a signal from his foreman, struck the key with a hammer. The key flew out and struck him in the eye, inflicting a serious injury. The injured employe sued his employer for damages, as a result of the injury, contending that the accident was caused through negligence of the employer and foreman in providing a worn key. The lower Court held the employer liable, but the higher Court reversed this verdict and in holding the injured employe not entitled to a recovery, said:

"The employer is not an insurer of the safety of his employes. He must, however, exercise ordinary care to furnish his employes a reasonably safe place in which to work and reasonably safe tools and appliances with which to work. . . . Along with the duty of the employer to use ordinary care for the safety of his employes goes the duty of the employe to use ordinary care for his own safety. He cannot, under all circumstances, blindly rely on the master and pay no attention to his own safety, but must use his own faculties and his own judgment and knowledge of the facts in taking care of himself. The master has the right to rely upon the servant to do that thing, and that fact must be kept in mind in determining whether or not the master has discharged his duty toward the servant. This right of the master to rely upon the servant using ordinary care for his own safety has led to the formulation of the rule which, in certain instances, permits the master to delegate to the servant himself the duty of performing certain work in preparing the place where or upon which he is to work and, if the servant in that case negligently makes a mistake, the servant, and not the master, is liable for the consequences. . . . The duty on the part of the servant includes the use of his faculties and powers of mind, which may be increased by skill acquired from experience. When skill is acquired by a servant, it is as much his duty to use his knowledge and skill for his own safety as to use them for the benefit of his employer in performing the work assigned to him."

Contractor's Bondsman Liable For Payment

As a matter of fair dealing, between the contractor and surety, the contractor should direct creditors to apply moneys which he has received under the contract to the beneficial interest of the surety. On the other hand, if the contractor fails to do so, the surety may not compel the contractor's creditor to make proper application of the money.

In McGeorge Gravel Co. v. United States Fidelity & Guaranty Co., 274 Pac. 503, it was disclosed that a contractor furnished a bond, with a surety company, which guaranteed that the contractor should faithfully perform his contract. During the progress of the work the contractor became bankrupt and was unable to pay for certain non-metallic products which were sold to him.

The gravel company filed its claim for $846 with the surety company. The latter contended that only $236 was due on the contract price because the contractor had paid $610 additional to the gravel company from moneys received from the owner. However, it was shown that the contractor had several accounts with the gravel company and that he had paid the $610 *without specifying which account should be credited with payment.* Therefore, the Court held the surety liable for full payment of the $846, saying:

"In transactions like the one under consideration, the surety has ample facilities for protecting itself. It may with propriety reserve and exercise a surveillance over the disbursement of the proceeds of contracts for the performance of which it is surety. Materialmen dealing with contractors cannot do so. They cannot, consistent with business proprieties, inquire into the sources of money paid them. When a surety, as in the case at bar, permits money on the contract to be paid the contractor unconditionally, which it must know he may use for general purposes, we see no sufficient reason for sustaining any claim or equity in behalf of the surety, in such money, after it has been paid to another in the due course of business. The risk of such a loss is one of the hazards which the surety, for a fixed consideration, assumes by its contract."

Who Is Independent Contractor?

The law is well established that an employer who employs a person to work as an "independent contractor" is not liable in damages for injuries sustained by the latter or his employes.

Generally speaking, an independent contractor is one who 1) undertakes to perform work requiring skill; 2) was employed to produce *certain results according to his own means* and methods and to employ his own help; 3) was to furnish *a part or all of the materials or appliances* for doing the work, 4) was engaged in a distinct and recognized employment, and was to be paid *either a gross sum of money or with reference to a quantitative standard;* 5) was free as to his hours of labor and under *no* obligation to work exclusively for his employer.

In fact, any one who accepts work under these conditions is an independent contractor, and his employer is *not* liable in damages for any injuries to his men, particularly where the injuries do not result from the employer's negligence.

For illustration, in Southern Surety Co. v. Shoemake, 16 S. W. 951, an employer hired the owner of a motor truck to haul gravel at $1.50 per yard. The employer told him to haul from a specified pit, and furnished him shovels to load his truck. The owner of the truck employed his own labor to assist him in loading and unloading his truck, and the employer had no one at his gravel pit to direct or supervise the loading. When the gravel was hauled to the job the employer inspected it, directed where to unload it, and issued a ticket entitling the employe to be paid for the quantity hauled.

The employe was seriously injured as a result of a cave-in and sued the employer for compensation for the injury. The employer attempted to avoid liability on the contention that the employe was an "independent contractor." However, the Court held that an employe who works under these conditions is not an independent contractor, thus holding the employer liable, stating important law, as follows:

"The general principles in determining the relationship are fairly well settled, but their application must depend upon the facts of each particular case. The test in determining the relationship is variously expressed but now appears to be *whether or not the employer reserved to himself the right to control the one employed* in the material details of the employment. It need not extend to the minutest or unimportant details. Nor is it essential that the employer exercise such right by actual interference with or regulation of such details of the work. Whether he retained the right of such control is what constitutes the test. . . The evidence in this case presents a close question . . . the fact that the one employed uses his own discretion as to his hours of labor, is to be paid with a reference to a quantitative standard, and furnishes some of his appliances, conclusive that he is an independent contractor. . . . Certainly the hauling of gravel, loaded with shovels could not be classed as requiring special skill. Nor could gravel delivered in its original state as taken from the earth be said to be a finished product by the use of skill. . . . The unrestricted right of the employer to end the service whenever he chooses, without regard to the final result of the work itself, is a very strong and sometimes conclusive circumstance indicating a relationship of employe, instead of that of independent contractor. . . . These elements, together with the testimony that Horn directed Shoemake (employe) where to get the gravel, what kind he should haul, and where he should unload it, raised an issue . . . whether he was an employe, and not an independent contractor as a matter of law."

Double Hernia Not Total Disability

In Golconda Portland Cement Co. v. Industrial Commission, 153 N. E. 594, it was disclosed that a workman sustained a double hernia while lifting a heavy object. The employe worked a little after sustaining the injury, but he was unable to assist in lifting. He sought compensation on the basis of total disability. However, the Court refused to grant the allowance, saying:

"An award for permanent total disability and a pension for life is justified only in case the employe is rendered wholly and permanently incapable of work and is upon the application to establish, by competent evidence, the legitimate conclusion that the accidental injury produced total and permanent disability. . . . While the evidence in this case tends to show that it is reasonably certain that defendant (workman) will be partially permanently incapacitated by reason of the hernia, unless it is reduced by an operation, the evidence in the case fails to show that it is reasonably certain that he will be permanently totally incapacitated."

REVIEW OF FOREIGN PRACTICE

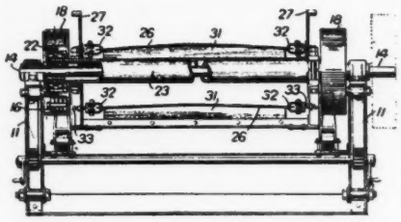


Fig. 1

Sifting Sand and Gravel

In apparatus for screening crushed stone, sand and gravel, a rotary shaft mounted in stationary bearings imparts to the screening element a positive gyratory movement in circular paths at right angles to the shaft and a resilient support is provided to maintain the screening element in its correct position by acting thereon simultaneously in the same direction on both sides of the shaft. The resilient support also acts as the means for varying the inclination of the screen. In the construction shown, Fig. 1, a frame 27, which may be in two parts bolted together, is clamped on a tubular shaft 23 and carries two superimposed screens 26. The shaft 23 has a bearing in an annular eccentric 22 provided on a rotary shaft 14 which works in fixed bearings on the supports 11. The eccentric is of the adjustable type comprising two concentric members of equal eccentricity, and is formed in one with a fly-wheel 18 carrying adjustable weights 16 to balance the centrifugal force of the screen. The screen frame is supported by half-springs 48 and upright and pendant links 52 as shown in Fig. 2. Adjustment of the inclination of the screen is obtained by securing the springs at their mid-points to a frame 37 pivoted to the supports 11 at their upper ends 39. A shaft 43 carried by the frames carries pinions 45 engaging with a segmental rack 46 on the supports. Studs 40 carried by the lower part of the frame 37 work in arcuate slots 41 in the supports and are clamped to secure the screen frame in any required position. The screens 26 are stretched over upwardly curved supporting bars 31 to prevent whipping by clamps 32 and tensioning screws 33. Preferably the feed ends of the screens are made independently removable to allow for extra wear and replacement of these parts of the screen. A. E. White (British Patent 312,565).

Colloidal Silica and Lime

Calcium silicates, obtained by heating at high temperature are attacked by water. Some lime and some silica pass into solution and react upon each other to form hydrated products. Addition of an excess of lime-water causes the formation of a solution of colloidal silica. There is no simple relation between the quantities of silica and lime contained in the precipitate at the moment of formation, this ratio varying from 10 to 1, depending upon the concentrations of silica and lime. The precipitation of the silica is a phenomenon of coagulation due to the action of the lime. The lime contained in the precipitated silica is present by adsorption rather than in combination and this adsorbed lime remains with the silica for months, if the solution is rich in lime. Johbois and Chassevent (*Le Ciment*, July, 1929).

Dry and Wet Cement Processes

A comparison was made of the yield of portland cement and the coal consumption by the dry and wet processes. The kilns produced 10 tons per hour. In a works using the wet process, the kiln and cooler having a total length of 280 ft., the diameter being 8 ft., except the sintering zone which was 10 ft. The fuel consumption per ton of cement was 36 lb. In a plant using the dry process in a kiln 220 ft. long, comprising a cooler 6½ ft. wide, the sintering zone being 10 ft. in diameter, the fuel consumption was 21.75 lb. per ton of cement. The advantage remains strongly with the dry process. Henri Pooly (*Cement & Cem. Manuf.* and *Le Ciment*, July, 1929).

Anhydrite Cement

Anhydrite cement is known as the product obtained by burning the naturally occurring gypsum ($CaSO_4 . 2H_2O$) to a temperature varying from 400 to 750 degrees C., and afterward grinding with various additions. Instead of burnt dihydrated gypsum, naturally occurring anhydrite may be used, in which case the additive materials may be ground in directly. The best product is dead-burned gypsum, produced at a temperature of 600 to 700 degrees C. The best catalyst has been found to be a mixture of sodium bisulphate and copper sulphate. Calcium sulphate, hydrated, burned at 600 to 700 degrees C. for 5 to 6 hours

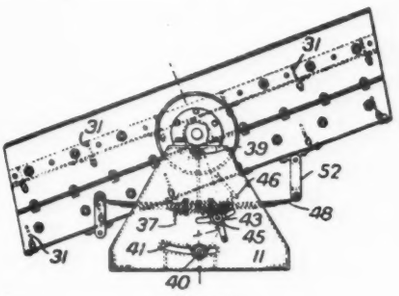


Fig. 2

and subsequently finely ground, sets with 28 to 30 per cent of its weight of gauging water in which 0.5 to 0.6 per cent $NaHSO_4$ and 0.8 to 0.9 per cent copper sulphate have been dissolved. The mechanical strength of the final material depends upon the purity of the ingredients, the time of burning, the burning temperature, the fineness after grinding, and the concentration of the catalysers. It reaches, after 28 days, a tensile strength of 966 lb. per sq. in., and a compressive strength of 8,500 lb. per sq. in. Coarse grinding lowers these values. The catalysts can be added either to the ground cement or to the gauging water. Anhydrite cement is plastic. It can be mixed with sand (1:1 to 1:3), peat or sawdust. Its volume does not increase upon solidification. The setting requires 30 to 60 minutes, when the temperature rises 9 to 10 deg. F. Anhydrite cement can be regenerated without the use of catalysts. Lime injures the mechanical strength of the anhydrite cement. The fluctuation of its mechanical strength in the course of time is explainable through the formation of an unstable complex hydrate. P. P. Budnikoff, Russia (*Zement*, August 1, 1929).

[Editorial note: This use of dead-burned gypsum as a cement is interesting in view of the fact that, in burning gypsum to plaster of paris, every effort is made to prevent dead burning, since the presence of anhydrous calcium sulphate lessens the strength of the plaster.]

Artificial Stone.

The manufacture of artificial stone by pressing or molding a mixture of blast-furnace slag and CaO is improved by correlating the addition of water to the mixture and the pressing or molding of the mixture so that the slaking heat of the CaO is available during the hardening process. Ludwig Fiala. Austrian Patent 112,979. Dec. 15, 1928. C. A.

Clay and Bauxite As a Source of $Al_2(SO_4)_3$

Bauxite, clay, and other iron-bearing aluminiferous minerals are treated to obtain aluminum sulphate free from iron. The material is placed in a rotary kiln, and treated with a counter-current stream of gases containing sulphur trioxide or sulphur dioxide and oxygen at a temperature intermediate between the decomposition temperatures of aluminum and ferric sulphates, making allowance for the partial pressure of SO_3 in the gases. A gas containing 7 per cent of SO_3 is passed over crude bauxite at 600 to 750 deg. C. When wet clay is used as raw material, it is first dried by the waste gases. Another process consists of treating the materials in a rotary kiln with gases containing sulphur dioxide and oxygen at 450 deg. C. (below the decomposition temperature of ferric sulphate) and then heating to 650 degrees C. to cause decomposition of the ferric, and formation of aluminum sulphate. An iron catalyst is used to assist the conversion of SO_2 to SO_3. G. F. Horsley & Imp. Chem. Industries Ltd. (British Patent 312,726).

Testing and Analyzing Cements

Erculisse considers that the evolution of methods for the testing and analysis of cements should be along the following lines: 1) express the results of chemical analysis by a formula indicating the stoichiometrical relationships; 2) as regards mechanical tests, use sand of definite size of grains, and make a more fluid mortar containing a little less sand than is used at present and exactly the amount of water theoretically required for setting, the mortar being prepared on a shaking table under specified conditions instead of being mixed by hand; 3) study the reactivity by LeChatelier's method. Paul Erculisse. *Chimie & Industrie* Special No., 475-87. (Feb., 1929). C. A.

Mixing Cement

Apparatus for mixing quick-setting cements comprises a container in which stirrers can be rotated at varying speeds and the walls of which are kept clean by rotating scrapers. By these means, the rate of hydration can be controlled, and premature crystallization by the introduction of material set on the walls is prevented. In Fig. 3, the container 1, provided with a discharge channel 3 closed by a door 2, is furnished with radial stirrers 13 which are of stream-line cross-section and mounted on a ver-

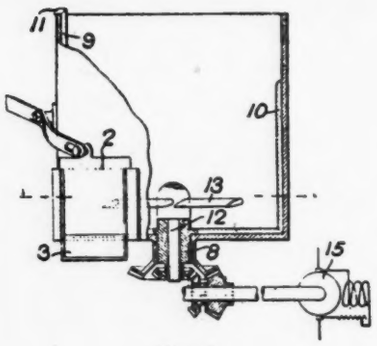


Fig. 3

tical shaft 12. The walls and lip of the container are kept clean by scrapers 9, 10, 11, mounted on a sleeve 8. As shown, the shaft 12 and sleeve 8 are driven by a motor 15. The stirrers are coated with soft rubber to prevent adhesion of the material thereto. G. M. Thomson. (British Patent 313,018).

Lime, the Chemical Plow.

Lime plays a most important role in the fertilizing of soils. Basic lime compounds alter the structure of the surface layer in a most favorable manner, causing a disintegration of lumps into porous granular form. The finest variety of soil consists mainly of humus and aluminum silicate, which mixture, in a region poor in lime, assumes a slimy form, and when dried by the sun becomes cemented to an impervious mass. Introduction of lime in such soils, causes a combination of the slimy, colloidal particles with the lime, with resulting loosening due to the flocculation and crumbling of the colloids. The soil is then in a crumbly state and approaches the condition most favoring fertility. If additions of lime are not made at intervals, the lime disappears from the soil, due to absorption by plants and by washing out, and the soil returns to its original, unfavorable, colloidal, cement-like condition. That a loose soil is far more favorable to plant growth has been demonstrated repeatedly. Dr. A. Fruhstorfer, Berlin (*Tarindustrie-Zeitung*, July 18, 1929).

The Flourometer: An Apparatus for Cements

A brief description of the Mayntz-Petersen flourometer, in which the fineness is determined by an air-elutriation test. Generally speaking, cement leaving a 12 per cent residue on a sieve having 4,900 meshes per sq. cm. will leave 38 per cent residue in the flourometer after blowing air for 15 minutes under a pressure of 6 cm. of turpentine; and a cement leaving 2 per cent residue on the same sieve will leave 25.4 per cent residue in the flourometer under the same conditions. But the results can vary with the nature of the cement and of the grinding equipment. G. Baire. *Chimie & Industrie* Special No., 472-3 (Feb., 1929). C. A.

Efficiency of Gas-Fired Lime Kilns

An analysis of the heat balance and equilibrium conditions of a lime kiln, with reasonable assumptions as to radiation loss, shows that the heat liberated by the gas is equal to the heat required to raise the flue gases, exclusive of the carbon dioxide from the limestone, to a temperature, t, less the heat given off in cooling the lime below the temperature, t, plus 840 calories per gm. of quicklime produced. The temperature, t, is that at which calcium carbonate has a carbon dioxide pressure equal to the carbon dioxide partial pressures in the stack gases. The efficiency of a kiln increases as the flame temperature of the fuel rises; 70 per cent is a maximum unless the heat of the flue gases is recovered.—A Schack. (*Wärmewirtschaft* 7, 65-69 C. A.)

Trass and Plaster

The influence of the addition of trass upon setting time of plaster, and also upon its tensile strength is similar to the effect of such additions upon the strength of portland cement. (1) The time of setting both of casts and coatings increases with greater trass content. (2) The tensile strength increases up to a definite trass content, and then decreases rapidly with further addition. This influence becomes positive only after seven days. After one day the effect is not definite. —A. Steopoe (Rumania) (*Tonindustrie-Zeit.* July 1, 1929).

Waterproofing Cement

A water-proofing and glaze forming composition for adding to the gauging water of cement mortars and concrete comprises a mixture of metallic sulphates or other salts. The preferred mixture comprises equal volumes of aluminum, magnesium, sodium and potassium sulphate. Various changes may be made in this mixture. Calcium chloride is not used. For example, one mixture consists of 2 parts sodium sulphate, 2 parts zinc sulphate, 4 parts potassium chloride and 1 part magnesium chloride. Another, equal parts of sodium silicate, aluminum sulphate, potassium chloride and magnesium sulphate.—A. Wetherell (British Patent 310.875).

NEWS FLASHES

Gilmore Cement Company Opens Quarry

The Northwestern States Portland Cement company, located near Gilmore City, has resumed work in the quarry and is also crushing rock. Twenty-seven men have been employed and it is said that they will operate fourteen hours each day instead of the usual twenty-hour day. Approximately four hundred and fifty tons are being shipped each day. The company will supply the rock for the paving state highway No. 20 east of Fort Dodge in Webster county.

Combustion Engineering Changes Its Boston Representatives

Combustion Engineering Corporation announces the discontinuance of its New England agency representation with Schumaker-Santry Company of Boston, effective August 15, 1929, and the establishment of a Boston district office at 100 Arlington Street. Messrs. F. L. Farrell and D. F. Jones, formerly of the Schumaker-Santry Company, have associated as Farrell & Jones and have taken over the accounts formerly handled by Schumaker-Santry Company. Farrell & Jones will be located at 10 High Street, Boston.

The following personnel has been appointed for the new Combustion Engineering district office: J. J. Brady, district manager, M. E. Yeager, sales engineer, and S. J. Harris, merchandise salesman.

New Silos for Canada Cement

The Canada Cement Company, Limited, will erect two cement silos, each measuring 40 ft. in diameter in Windsor, Ont. The silos, which are to cost approximately $60,000, will be used for the storage of cement supplies for use throughout the west. It is expected that the company will construct a packing plant in conjunction with the silos.

Receiver Is Appointed for Oolitic Company

Albert R. Marley, a banker of Spencer, Ind., has been appointed by Judge Herbert Rundell of the Monroe Circuit court as receiver of the Indianapolis Oolitic Stone Company's plant at Stinesville, twelve miles north of Bloomington. Officers of the company did not oppose the court action. Mariel M. Streicher, a mechanic and laborer at the quarry, filed a receivership petition a few days ago alleging that the company is insolvent and that it owes more than seventy men between $12,000 and $13,000 for labor in addition to sums it owes banks.

Marquette Cement Company Building Depot at Memphis

J. B. Simmons has announced that the big new packing depot of the Marquette Cement Company under construction along the water front at Memphis, Tenn., will be ready for the official opening with the arrival here of the first tow of cement on the first day of fall. Its yards and street approaches will be completed later.

The first cargo of cement will arrive under tow of the "El Capitan" from St. Louis and Cape Girardeau, Mo. A boat and six steel barges are being built by the cement company and later will be used solely in the trade between Memphis and Missouri points.

Cement brought here for distribution will be unloaded from the specially built barges into silos by pipe lines. Machines for bagging it make up a big part of the plant's equipment. The daily capacity is 12,000 barrels or 48,000 sacks of the cement.

Smith Engineering Works to Enlarge Plant

Contracts calling for enlarging its present plant have just been awarded by the Smith Engineering Works of Milwaukee to the Milwaukee Structural Steel Co. and Merideth Bros. Co. This expansion was made imperative by recent large contracts for Telsmith crushing and gravel plants for shipment to Russia and Mexico, and construction work on the new building is already under way. The extension will be 150 feet long by 90 feet wide; of fire-proof construction, with steel frame, tile roof, concrete foundation and floors, and brick walls. It is expected that the building will be completed by September 15th.

New Plant to Grind Cyanite

The Pacific Rock Products Company of Los Angeles is constructing a new plant at Ogilby, Calif., to fine-grind cyanite and mica schist. The properties at that point have been operated for some time but the material heretofore has been shipped to Los Angeles and custom ground. Cyanite is used in making porcelains for spark plugs and other porcelain objects that are subject to intense heat. The mica schist is fine-ground and used to dust roofing papers, automobile tires and other rubber products. An aerial tram will be installed to convey the material from the pit to the new plant.

The company at present operate a plant in Los Angeles to crush brick, tile, red rock, green rock, slag and china. This crushed material is sold for roofing rock. The officers of the company are: C. F. Allebrand, president and general manager; W. B. Ogden, vice-president; and Harry Story, secretary and treasurer.

Cement Manufacture Being Resumed at Rosendale, N. Y.

A new cement mill is nearing completion at Rosendale, N. Y., and residents of the town who recall the olden days of the Rosendale cement business are hoping for a revival of activities on a large scale.

Some months ago the Century Cement Company became interested in the possibilities of Rosendale cement and, having established a demand for natural cement, they sought a source of supply at Rosendale which produced the highest quality of natural cement. The Andrew J. Snyder mill which had been operating on a small scale, turning out a limited quantity of cement, was secured as was the old Beach mill property between Binnewater and Rosendale.

The Snyder kilns have been refaced and placed in first-class order for the burning of cement. The Snyder quarries will be operated and a spur over the Beach property connecting the plant with the Wallkill Valley Railroad has been completed, and a conveyor for the carrying of the cement from the kilns to the mill has been erected. There remains still some work to be done before the plant can be put into operation. As the demand grows for the product additions are anticipated to the mill.

Erection of the plant and installation of the new machinery has been done by the Burrell Construction Company, a concern which specializes in mill work.

Tonko Milac, of Paris, France, writes that he proposes to undertake the manufacture of calcined gypsums, the raw material to come from his own large quarry.

Dredging Company Begins Limestone Quarrying

The Waterloo Dredging Company of Waterloo, Ia., has recently added a limestone quarry to its other activities and is producing at present 100 yards per day of 1-inch and 1½-inch stone. It has a 10-acre deposit, 30 ft. in depth. Samples submitted to the Iowa State College laboratories tested 89.4 per cent pure lime or calcium carbonate.

The test results as follows:

Retained on 10-mesh screen 40 per cent.

Retained on 20-mesh screen 18 per cent.

Retained on 40-mesh screen 12 per cent.

Passing through 40-mesh screen 30 per cent.

A 15-in. by 36-in. Universal jaw crusher is in operation. Concrete stave storage bins have been installed with capacity of 160 yards. The plant has been in operation two months and there has been such a lively demand for the dust that installation of a pulverizer is being considered.

This is a partnership, including H. C. Matthias, G. N. Cousins and E. H. Matthias. The latter is the only active partner and is general manager, in charge of the quarry.

Chain Belt Moves Houston Office

The Houston office of the Chain Belt Company, Milwaukee, manufacturers of Rex deep well oil chains, conveyors, and concrete mixers, has moved to larger quarters at 1310 Second National Bank Building. This office was formerly at 1000 Marine Bank Building. Mr. Russell G. Davis is manager.

Safety Celebration at Rogers City

Thursday, August 22 was a gala day in Rogers City, Mich., when the Michigan Limestone & Chemical Co. closed its big plant and gave employees, the entire town, and numerous visitors a safety celebration and picnic. The festivities are estimated to have cost the company $10,000 and included boxing, wrestling, and tennis matches, a baseball game, running races, water sports, a talkie, safety flag ceremony, noon lunch, a circus, band concerts, fireworks and a dance.

Wholesale Distributors Combine

Effective October 1, 1929, the fourteen wholesale distributing corporations owned by the General Electric Company will be consolidated into the General Electric Supply Corporation (of Delaware). These companies have for many years distributed General Electric products and the plan involves no change of ownership. The consolidated corporation will be in a much better position to offer nationwide service through its ability to give service from any one of seventy-six houses, through interchangeabiilty of stocks, and speedier and more economical operation.

The tentative organization plans indicate corporate officers and directors as follows:

Gerard Swope, chairman of board; C. E. Patterson, president and director; J. L. Buchanan, executive vice president and director; J. G. Johannesen, vice president, Eastern Region, and director; D. E. Harris, vice president, Western Region, and director; N. R. Birge, director; A. D. Cameron, director; H. C. Houck, director; J. E. Kewley, director; G. C. Osborn, director; T. K. Quinn, director; E. O. Shreve, director; C. E. Wilson, director; L. R. Link, secretary-treasurer; and L. M. Nichols, comptroller.

The department heads, district managers and other officers will be announced when appointed at October 1st.

Basic Rock Gets Contract

The Florida Basic Rock Company of Marianna, Fla., has just been awarded a contract to supply the state road department of Florida with a considerable tonnage of base lime rock to be shipped to the Coastal Highway east of Panama City.

The stockholders and directors of the Florida Basic Rock Company are W. S. Brandon, Carl A. Robinson, D. P. Daniel and W. A. McQuagge. The plant is situated about twelve miles northwest of Marianna on the old Campbellton road. It is served by an industrial spur track leading from the Atlantic and St. Andrews Bay Railroad.

Woodstock Slag Operating to Capacity

The Woodstock Slag Corporation, producers of ready-mixed concrete and commercial slag, reports steady growth of ready-mixed concrete sales since opening of this department.

Its plant, located in East Birmingham, Ala., and previously described in PIT AND QUARRY, is a most modern plant for producing ready-mixed concrete, being of concrete and steel construction throughout, all equipment being automatically controlled.

Producing its own screened slag for use in concrete, it is in position to control accurately the sizing of the coarse aggregate used in the mixes and can give each customer absolutely such sizing as is required for each job. Orders are increasing and prospects are reported as being bright for a steady volume of business for the next several months. Ready-mixed concrete is being furnished by the Woodstock Slag Corporation for the large city paving projects and also for the larger building constructions.

Wausau Offers Site Subject to Size of Payroll

A free site for a plant will be deeded by Wausau, Wis., to the newly formed Wisconsin Black Granite Corporation if it pays out $45,000 to workmen within the next three years. The proposal was passed by the city council, the land has been selected and the firm will take possession at once.

The plant will develop a new black granite recently discovered at Dudley, Lincoln county, Wis., which will be trucked 20 miles to Wausau. The quarry is large enough to supply the works for an indefinite period.

Stone Concern Leases Fruit Firm Holding

Two sections of land near Red road and Fourteenth street, outside Miami and Coral Gables city limits in the southwest section have been leased by the Atlas Rock Company of Miami, Fla., from the Seminole Fruit and Land Company on a royalty basis, according to J. Martin Deer, president of the rock company.

The contract, signed by Mr. Deer and W. J. Weller, president of the lessor company, calls for joint expenditure by the two parties of approximately $100,000 for machinery and equipment, including two and one-half miles of railroad track for hauling crushed stone from the plant to the Seaboard Air Line Railroad.

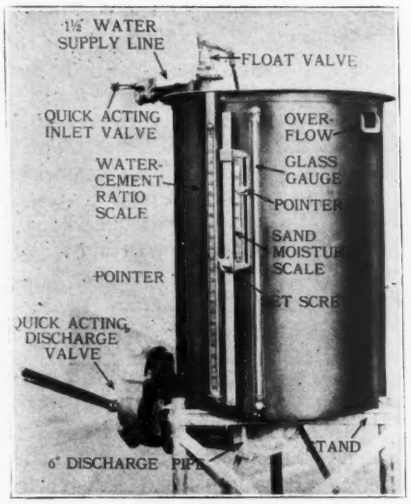
Crushed rock will be supplied to building contractors in Metropolitan Miami, to road building and maintenance contractors and as ballast for railroad beds. Previously, much rock for these purposes came from the bay bottom and has been taken to destinations by barge or truck fleets. These means of transportation will continue in use by the company.

The Atlas Rock Company was established March, 1922, by J. W. Deer, Chicago contractor. John Martin Deer, son of the founder, now is president of the organization.

Detroit Firm Moves

The Acme Equipment Company, Inc., dealers in new and used contractors' equipment and supplies, announces its removal to new offices and warehouse at 3352 Michigan Ave., Detroit, Mich.

NEW MACHINERY AND SUPPLIES



Water-measuring tank

New Water Measuring Tank

The Blaw-Knox Company has perfected a water measuring device for the accurate control of the water-cement ratio in the mixing of concrete. This device is known as the Blaw-Knox Water Cement Ratio Measuring Tank, and it is designed to be used with Mixers of one, two and three cubic yard capacities; also intermediate sizes.

This new water measuring tank is made in two styles, namely—*manual and automatic.* Both are open top tanks and are equipped with calibrated scales on the outside of the tank, and water gauge glasses showing the level of water in the tank at all times.

In the manually operated tank, the operator sets a pointer opposite the exact number of pounds of cement to be used in the bath and in accordance with the water-cement ratio specified. An auxiliary scale is provided by means of which a deduction is made from the amount of water to be measured out to compensate for the moisture contained in the aggregate. The manual tank is filled to the top level for every batch. The filling is controlled by means of a float valve, and an overflow prevents any possibility of error. The amount of water for the batch is then fed into the mixer simply by opening the discharge valve and closing it when the desired level of water in the tank has been reached.

The automatic tank is arranged similar to the manual tank as described above, except that it is fitted with an adjustable overflow funnel located inside the tank and at the center of it. When the pointer is set for the required amount of water, the overflow funnel is automatially set at the same level. The tank is then filled, and as soon as the water reaches the overflow level, the valve controlling the supply of water is closed. When it is desired to charge this accurately measured amount of water into the mixer, the discharge valve is open and the entire contents of the tank are drained into the mixer.

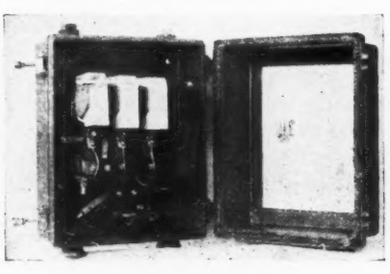
In both the manual and automatic tanks the amount of water measured out for each batch is clearly visible at all times. Any central mixing plant operator can operate this equipment. The inlet and outlet valves are large enough to insure quick filling and rapid discharge. The calibrated scales are of brass to prevent corrosion.

Dust-Tight Linestarter

The Westinghouse Electric and Manufacturing Company announces the development of dust-tight and weather proof linestarters. They are remote controlled, non-reversing, across-the-line type magnetic starters for single phase and polyphase squirrel-cage induction motors. These starters are especially adaptable for use in coke plants, cement mills, steel mills, and other places where a dust-tight starter is very desirable.

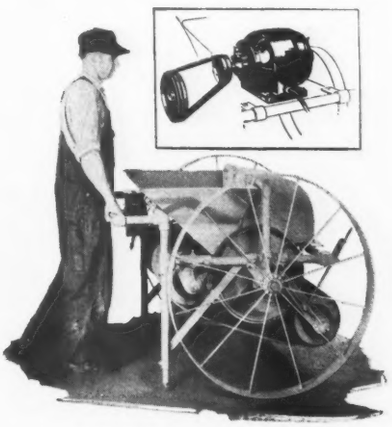
Several features have been added to the standard line to insure the continuous and efficient operation of linestarters. It differs from the other types in its cabinet construction in that a cast iron cabinet is used with a gasket seal on the door. The conduit is brought in through the top and bottom in threaded openings, so as to make a dust-tight connection. These features make the cabinet dust-proof and water-proof.

All dust-tight linestarters are equipped with the deion grid type arc quencher, the most effective arc rupturing device ever incorporated in linestarters. It not only provides for the highest degree of protection against flashovers even under the most severe operating conditions, but it also increases the life of the contacts.



New line starter

To prevent the operator from breaking the seal whenever the motor is put back in service after an overload, the two smaller size linestarters are equipped with an automatic reset thermal overload relay.



V-Belt on box car loaders

V-Belts for High Speed Box Car Loader

After testing various drives for the Sinden centrifugal box car loader, Stephens-Adamson Mfg. Co. has standardized on the multiple V-belt drive. The Stephens-Adamson loader is a compact, one-man machine for loading bulk materials such as sand, crushed stone, grain, fertilizer, etc., into box cars.

The machine consists of a short endless conveyor belt driven at high speed. The belt is given a concave bend on the carrying run by two discs which touch only at the outer edges. Material is dropped between the discs and meets the belt traveling in the same direction. As the load follows around the inside of the curve, centrifugal force causes it to cling to the high speed belt from which it is thrown to the ends of the box car. As the loader operates at high speed and often handles very dusty materials, the drive is of great importance.

The multiple strand V-belt operates quietly and without vibration. Due to the wedging action of the V-belt in the grooves there is no slippage even under extremely dusty conditions. Two strands are ample to carry the load fom the 3 h.p. Westinghouse motor, which can now be placed where it will improve the balance and portability of the loader.

The new rock drill

A New Rock Drill

One of the latest mahines in the industrial field is the new model 11 rock drill which is being produced by the Gardner-Denver Co. This is a light all-purpose drill that can be used for wet or dry drilling. It weighs only 50 pounds and has a drilling speed equal to that of muh heavier machines, the manufacturer says, and gives an unusually heavy daily footage with a minimum of strain upon the operator, due to smoothness of operation. It is rotated by a rifle bar and rachet.

This new drill may be mounted for light drifting, chanelling with a quarry bar, used on a tripod, or for miscellaneous work where a light mounted drill is desired. It takes steel ranging from ⅞ to one inch.

While in ordinary operation, this drill keeps the hole clean and free from cuttings by means of sending a strong air current through the drill steel. When drilling unusually deep holes, a special blowing device can be turned on. A single oil reservoir in the cylinder lubricates all moving parts or Gardner-Denver air line oilers can be used on it.

All the parts of this new drill are well balanced and made of the best alloy steel and drop forgings. Throughout its production, close precision is observed in all parts, which factor insures that the maintenance will be very low and the life of the drill will be much longer than average.

The drill has a tubular spool type of valve that has only short travel distance. It is positive in action regarding air admission and exhaust. The hammer is sturdy in construction and carefully machined. It has eight flutes on the area that contacts with the chuck driver. The cylinder bushing which is interposed between the cylinder and the chuck is a part that can easily be removed and replaced when worn by the hammer travel. The chuck end is made of a specially heat treated drop forging that has an integral lug for holding the steel retainer.

The chuck driver and chuck are made of alloy steel with one diameter construction. Eight splines take the rotative strain. With a liner that is pressed in steel, replacements can be made easily. The six fluted bar of the drill is held in sliding contact with a bronze nut. The rachet has four pawl plungers and four pawl springs which hold the pawls in contact with a rachet ring that may be reversed to give double service. The back head is drop forged and has a throttle valve and handle boss that are integral. The throttle valve and air connection are held in place by a spring when the air is shut off and by air pressure when the mahine is in operation.

The handle grips are of tire stock rubber that are held by a heavy through bolt. The steel puller is of simple design and is operated by hand. The part which engages in the collar of the steel may be replaced when worn. The pivot is lubricated.

Westinghouse Develops New Metal

Officials of the Westinghouse Electric Manufacturing Company have announced the development of a new metal known as "Konel," which is credited with being much stronger than other metals at high temperatures and which can be used extensively in the moving parts of internal combustion engines and other extremely hot places. The announcement followed the granting of foreign patent rights.

Originally developed by the Westinghouse Research Laboratories as a substitute for platinum in the manufacture of filaments for radio tubes, the new metal was discovered to be harder to forge than steel, and to be very tough at high temperatures, when most metals lose their strength. It was created by Dr. E. F. Lowry, a graduate of Ohio State University. As a substitute of platinum, Westinghouse officials are authority for the statement that Konel already is saving approximately $250,000 monthly in the manufacture of radio tubes. Tubes with filaments made of the new metal are operated 175 degrees colder than tubes with platinum filaments but with the same emission, thereby giving better reception results, research engineers say.

Large Diameters Armored Cables Now Available

Power and control cable with interlocked, flexible metal armor for installation without a conduit in central station, industrial and other interior wiring has been announced by the General Electric Company. Cable provided with the armor can be run along walls, between partitions and under floors without the use of ducts, and the construction of the armor is such that turns in the cable can be made easily.

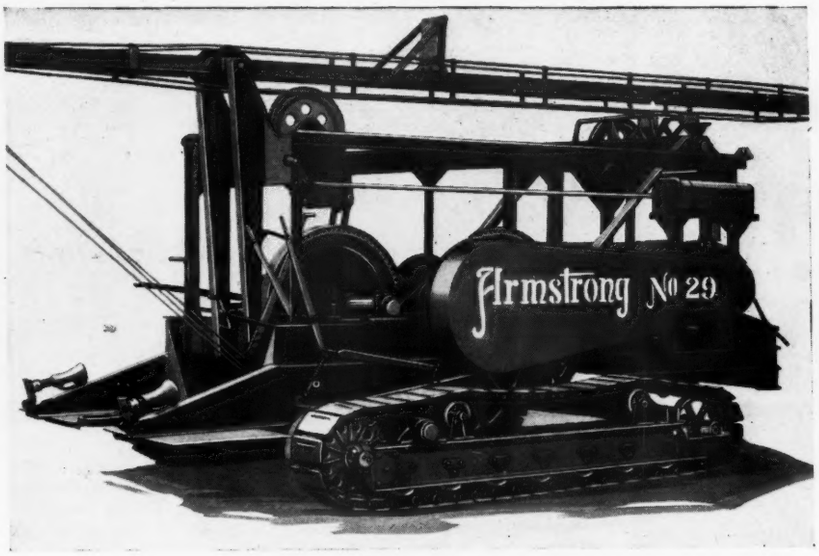
Varnished cambric and rubber-insulated, either taped, braided or leaded, and paper-leaded cable can be supplied with the armor, in lengths up to 1000 feet for cables with an overall diameter less than one inch and in lengths up to 2000 feet for cables with an overall diameter between one and three inches. The tables can have any number and combination of conductors, and any outside diameter up to three inches.

The armor is a layer of overlapping and interlocking metal tape, either galvanized steel or aluminum, so applied that the cable is always mechanically protected under reasonable installation conditions. The steel armor is suitable for most installations; the aluminum tape is for use where a noncorroding armor is required, and for single conductor cable carrying alternating current where the magnetic effect of steel is undesirable.

Armstrong Blast Hole Drill

Unequalled strength, greater drilling capacity and more moving ability are the controlling factors in the design of the new Armstrong No. 29 all steel blast hole drill.

This machine is a distinct departure from the so-called quarry drill of the well driller type. There is not a bolt nor rivet in either the frame or derrick construction. Every beam, upright, cross bar, brace and truss is electric arc welded in position. The whole frame is as solid, as rigid, as if



New blast hole drill.

it were sawed out of a solid block of steel—giving the rugged strength and stability so essential to heavy duty machinery.

The derrick, designed especially for wire rope, is equipped with the Armstrong improved wire line shock absorber, constructed of a series of rubber discs made from the best grade of tire tread stock. This provides a cushion 12 in. thick and prevents any shock or vibration of the tools or steel cable from being transmitted to the derrick or machine frame. The shock absorber also provides from 4 to 6 inches of elasticity on the drilling line.

The derrick is constructed of channel steel with truss rods, both front and back, supported by stiff leg braces anchored to the four corners of the frame, and to both the top and center of derrick, which permits moving machine over the roughest ground with the derrick raised and tools in position.

An important feature is the full length alligator treads, on which the machine is mounted. This is the same style of mounting as is used under power shovels, cranes and other heavy machinery.

The apron treads provide 22.2 sq. ft. of bearing area and each tread is 11 ft. 3 in. long. The machine can be turned around in a space no greater than its own length.

The machinery and its arrangement are particularly adapted to direct gas engine or electric drive, and all clutches, shafts, bearings and gears are oversize in order to give the best operating results and the lowest possible maintenance expense. Power is applied to the drilling motion through heavy steel machine cut gears. All gears, pinions, pulleys, belt, sprockets and chains are covered with heavy metal guards.

General Excavators Now Equipped With Six-Cylinder Engines

The General Excavator Company, manufacturers of convertible half-yard shovels, is now powering all machines with standard make six-cylinder engines. Built just like a big machine, only not so large, the General is capable of doing the same type of work as any of the larger capacity excavating machines. It can be quickly and easily changed in the field from one type of boom assembly to another without making any changes in the operating machinery. It is convertible to shovel, dragline, clamshell, crane, back-hoe, and back-filler service by simply changing the boom equipment.

Great strength and rigidity is obtained by the use of steel castings throughout. The machinery is simple in design and easy to operate. The powerful six cylinder engine assures plenty of reserve power and smooth rapid operation.

Improved "Loading-Block" Designed

Some power drag scraper operations, particularly the stripping of overburden and similar earth-moving work, call for an unusually frequent shifting of the line of operation, and on such work it is customary to use a rapid-shifting arrangement consisting of a "loading" or "flying" block riding one of the scraper operating lines, and controlled by a "shifting cable" which passes over a guide block at the edge of the property and then to a winch by which the shifting cable is paid out or taken up to control the digging position at will.

For this service, Sauerman Bros. has developed an improved loading block which is counterweighted so that regardless of the tension on the cables the block rides in a horizontal position and the operating cable always rides on the sheave and not against the housing of the block. This counterweight has an eye in the end through which the end of the shifting cable is passed and clipped to make a solid connection of the shifting cable with the block.

This block has all the advantageous features of the standard Sauerman "Durolite" guide block, such as the great strength in proportion to the weight of the block, and the advantage that it can be opened up to receive cable by merely removing one pin. The frame is of heat-treated alloy steel and sheave is of heat-treated alloy steel.

Geo. D. Whitcomb Building New Factory

The Geo. W. Whitcomb Company, manufacturers of industrial and railway locomotives, has broken ground for the construction of a new factory unit.

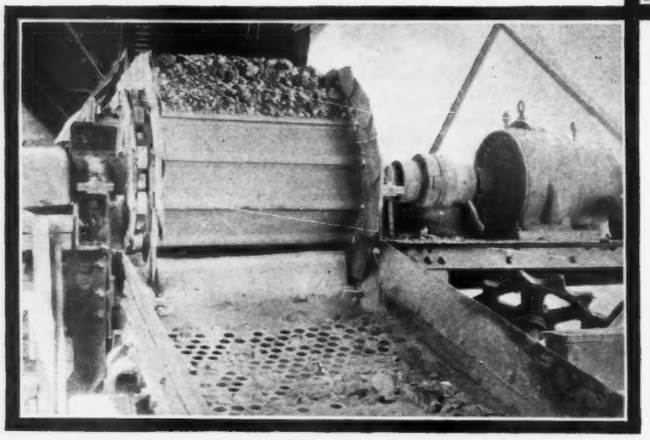
This structure and addition is to be completed within the next 30 to 40 days. Another addition to the manufacturing department is to be started soon.

This expansion is due to the increased activity of the company particularly in the large machines that it is selling to the railroads and will be used primarily for the erection of large oil-electric locomotives from 20 to 100 tons. Two cranes, one of them of 50-ton capacity, will serve this new erection bay and facilitate handling of large units.

Cast-Grid Rheostats

The control of current to slip-ring stationary motors, and direct-current crane or hoisting motors is advantageously controlled by the use of cast-grid resistors. This type of resistor is sturdy enough to withstand hard usage. The Columbia Electric Manufacturing Company makes such units known as cast-grid rheostats, of capacities ranging in current capacity from 400 amperes to 3,000 amperes. The switches are arranged to provide steps of about 2.5 per cent of full capacity, but the switches are furnished, when desired, to give 1 per cent regulation.

Making Slag Right for Concrete



THE Woodstock Slag Corporation of Birmingham, Ala., who operate a ready mix concrete plant in conjunction with their slag plant naturally chose a Dings Magnetic separator to insure positive removal of all the iron from their slag.

Where results count, Dings is the first choice. Let us send you further details.

DINGS MAGNETIC SEPARATOR CO.
670 Smith Street, Milwaukee, Wis.
Established in 1899

Dings High Intensity MAGNETIC SEPARATION

New York City 30 Church Street
Boston 304 Rice Bldg.
Chicago 332 S. La Salle St.
San Francisco 273 Seventh Street
Branch offices in other principal cities

P&Q 9-11-Gray

CABLE DRAGLINES
for
MINING OPERATIONS

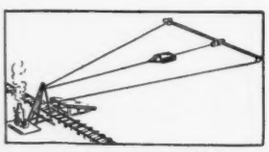
In one setting one man with an electric (two with steam) Schofield Burkett Cable Dragline will move 83,000 cubic yards from a triangular area with a span of 600 feet and a depth of 25 feet.

Automatic digging—Automatic shifting—Automatic Dumping!

Automatic digging is accomplished by the angle pull and a patented spring which prevents chattering.

Automatic shifting does away with the ridges so common to other types.

Automatic dumping insures you of a clean bucket and a full load next trip.

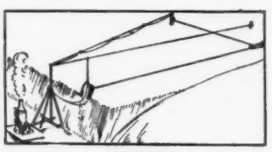


TYPE-A AUTOMATIC
Digging and Shifting

WESTERN OFFICE
506 E. Mulberry St.
San Antonio, Tex.

20 years experience

SCHOFIELD-BURKETT CONSTRUCTION CO.
General Offices
MACON, GA.



TYPE-B
Stripping System

EASTERN OFFICE
150-02 Sixth Ave.,
Whitestone, N. Y.

ARE YOUR DIGGING AND STRIPPING CONDITIONS LIKE THESE?

When you have gravel deposits under water— when you want to get away from too much moving of track or conveyor equipment—

Find out what you can do with BUCYRUS-ERIE Draglines. Reports from sand and gravel producers tell of excellent results— for instance, this one from Joliet Gravel Co. of Springfield, Ill.:

"Our BUCYRUS-ERIE 1½ to 2-yd. dragline is always ready to go— easily handles our gravel washing capacity and does its own stripping besides— is better than any other machine we have ever used."

Many more reports from owners show you why BUCYRUS-ERIE Draglines are noted for larger and steadier outputs, and lower costs.

Isn't this what you want in a dragline machine?

First, the advantage of greatest possible reach for loading out material, enabling your operator to strip a wider area, and dump at a distance from the cut when necessary.

Second, the Speed to produce a big output— plenty of power for fast digging, and perfect balance for a fast swing.

Third, the dependability that insures your washing plant a steady supply of material— the added strength that gives Reliability.

You'll find the dragline you want in the BUCYRUS-ERIE line—all sizes from ½-yard to 8-yard and larger— any kind of power. Write us, and get our recommendation for your work.

BUCYRUS-ERIE COMPANY
General Offices: South Milwaukee, Wis.
Plants: South Milwaukee, Wis.—Erie, Pa.—Evansville, Ind.

Representatives throughout the U. S. A. Offices and distributors in all principal countries of the world.

BUCYRUS ERIE

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Advertisement 763

Pit and Quarry

With which is consolidated CEMENT-MILL & QUARRY

Member Audit Bureau o Circulations

Reaches Largest Number of Plants

Published Biweekly on Wednesday for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime, and Other Non-Metallic Minerals.

Subscription price: $5 for 3 years, $2 for 1 year in the United States and possessions, North, Central and South America; elsewhere $1 additional for each year. Single copies 20c.

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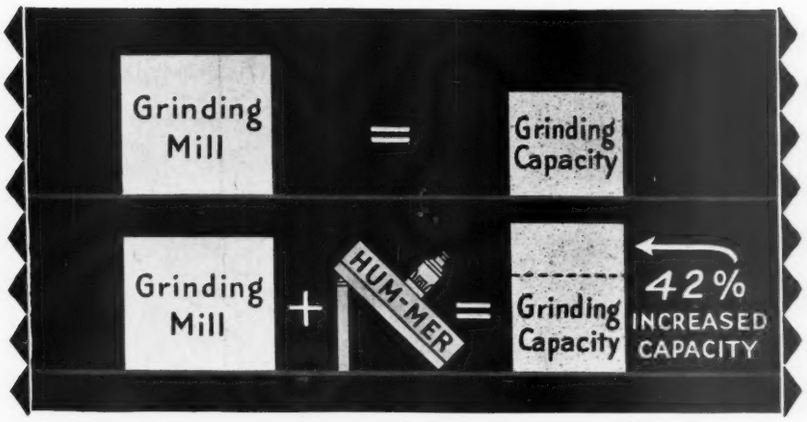


Boosts grinder capacity 42%!

WITH no change other than installing Hum-mer screens behind his grinding mills—

One superintendent increased his output of crushed material 42 per cent!

Less power was used—

A better product was made—

The operation of the grinder was smoother.

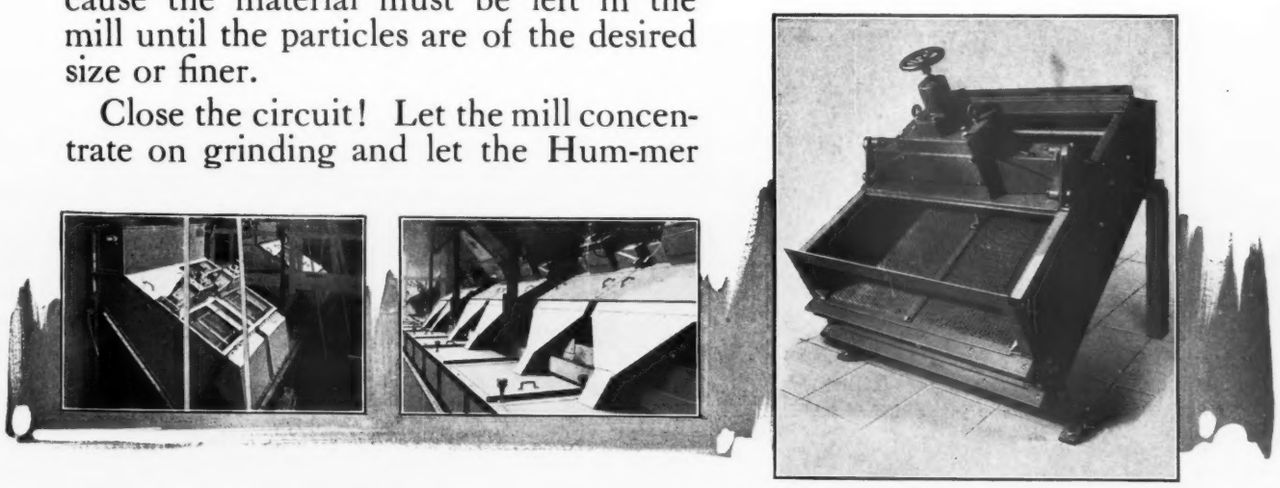
Why attempt to control the size of product by operating crushers in open circuit? This practice only results in cutting down the output of the mill, because the material must be left in the mill until the particles are of the desired size or finer.

Close the circuit! Let the mill concentrate on grinding and let the Hum-mer definitely control the sizing, returning the oversize to the grinder.

You can increase the capacity of your grinders and crushers anywhere from 15 to 100% by operating them in closed circuit with Hum-mers.

Let us give you actual data on the results you could expect.

THE W. S. TYLER COMPANY
Cleveland, Ohio
Manufacturers of **Woven Wire Screens and Screening Equipment**



HUM-MER *Electric* SCREEN

62
Roller Bearings
in the Lima "101"

"A Timken at every vital bearing point"

The only shovel, dragline, crane and dragshovel in the world so equipped.

Send for illustrated Bulletin 291

THE OHIO POWER SHOVEL CO.
LIMA, OHIO, U. S. A.

Western Office
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Chicago

Eastern Office
2351 Graybar Bldg.,
New York

The Ohio Power Shovel Co.
Lima, Ohio

Gentlemen: Send me further information about the Lima "101"

Firm name.....

By.....

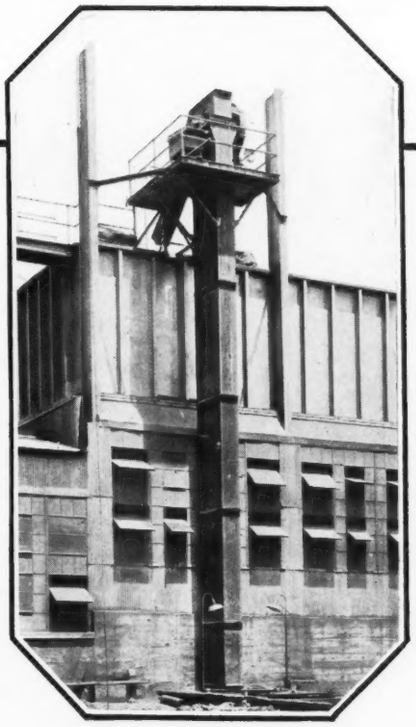
Address.....

.....

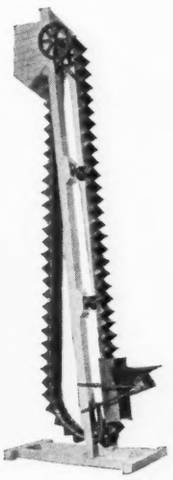
Nature of work.....

LIMA "101"

Jeffrey Elevators when enclosed are ideal for handling dusty materials. Steel casings provide rigidity and reduce need of auxiliary supports.



Jeffrey Enclosed Bucket Elevator handling cement clinker from rotary kiln to storage.



Jeffrey Continuous Bucket Elevator for handling large capacities of Stone and similar materials. Large sizes have buckets mounted on two strands of strong and durable Steel Thimble Roller Chains.

No Capacity Too Large No Job Too Tough

THE application of Jeffrey Bucket Elevators is so broad that all loose materials met with in Quarries, Cement, Lime and Gypsum Plants, can be handled regardless of capacity or working conditions.

Jeffrey standard elevators include Vertical, Inclined and Perfect Discharge types with a capacity range of 6½ to 750 tons per hour.

Enclosed elevators have heavy steel casings of either flanged or plate and angle type construction, insuring extreme rigidity.

Our new elevator catalog No. 465-M will tell you additional interesting facts about Jeffrey Bucket Elevators. Send for your copy.

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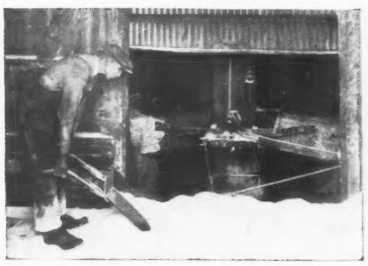
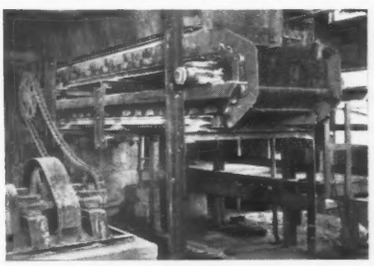
JEFFREY
MATERIAL HANDLING EQUIPMENT

JEFFREY EQUIPMENT *for* Elevating *and* Conveying



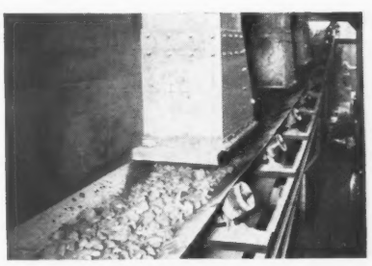
POWER SHOVEL

Saves time and labor in unloading loose bulk material which is shipped in box cars and is to be unloaded into chutes, hoppers, elevators or conveyors. Full particulars upon request.



APRON FEEDERS

For delivering material from track hoppers or bins to crushers or conveying units. Write for Catalog No. 435-R.



BELT CONVEYORS

Three and Five Pulley Carriers for belts 14 to 48 inches wide. Handle crushed stone, sand, gravel, etc. Send for Catalog No. 409-F.

SPIRAL CONVEYORS

Jeffrey Spiral Conveyors are particularly well fitted for handling fine materials such as Cement, Lime, and Gypsum. Flights are made in two types—Sectional and Helicoid.

Jeffrey Products

- Elevators
- Conveyors
- Portable Loaders
- Coal and Ashes Handling Equipment
- Skip Hoists
- Chains and Attachments
- Sprocket Wheels—Gears
- Crushers—Pulverizers
- Sand and Gravel Handling, Washing and Screening Equipment
- Locomotives
- Mine Equipment
- Ventilation Fans

DRY SAND

NO FREE WATER
NO CLAY
NO TRASH

Telsmith Twin-Screw Rewasher

Sand that's all sand . . . so dry that it doesn't drip . . . clean and clear of clay and dirt. The new Telsmith Twin-Screw Rewasher not only turns it out that way but handles large tonnage easily.

In the inclined washing trough, the counter current of wash water brings to the surface lignite, shale, mica, bark and trash. There's no chance for them to work upward along the screws . . . water sprays stop that . . . and the reverse currents keep these intruding substances moving until they finally float off over the spillway. As for clay, the big screws disintegrate it rapidly.

Sand piles up at the end of the screws. A low enclosure allows only the dry sand from the top of the pile to discharge through the central vent . . . while the water drains back from the bottom of the sand pile. There is no free water in the product.

Equally efficient and similar in principle, the TELSMITH SINGLE SCREW REWASHER may be used where capacity requirements are not so strenuous.

Telsmith-Hercules Gravel Washer

A NEW Washing Screen with these Outstanding IMPROVEMENTS

Timken Roller Bearings Throughout

All-Metal Construction
Easily Replaceable Screen Plates
Ball Mill Scrubber
Chain Disintegrators.

Write today for Bulletin S-H 15 describing both of these new devices in detail. *See* P&Q HAND BOOK Pages 183-274.

SMITH ENGINEERING WORKS

88 CAPITOL DRIVE, MILWAUKEE, WIS.

CANADIAN REPRESENTATIVES:
Canadian Ingersoll-Rand Co., Ltd., Montreal, P. Q.

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Brandeis M. & S. Co. Louisville, Ky.

24-ton Plymouth Gasoline Locomotive at the Lawrence Portland Cement Company's Siegfried Plant.

Of course they bought more Plymouths

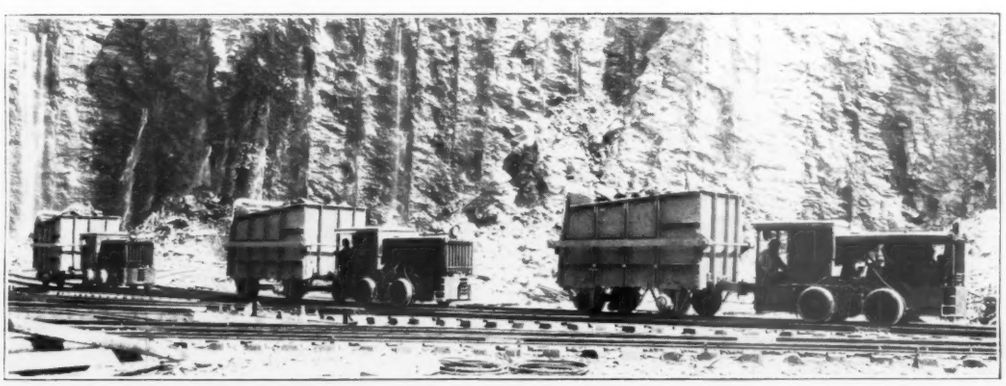
The Lawrence Portland Cement Company of Northampton, Penna., is one of the pioneer cement manufacturers in this country, their original plant having been built about 1887. In 1921, they purchased a 6-ton Plymouth Gasoline Locomotive for use at their Annville, Penna., quarry. This locomotive is still in daily use, giving highly efficient service. They were so satisfied with its results that they have been Plymouth boosters ever since. Now seven Plymouths are operating very profitably, the 6-ton at Annville, three 7-ton and one 24-ton at Siegfried, Penna., and one 10-ton and one 24-ton at Rockland, Maine.

The quarry at Siegfried is a large one, 200 feet deep, and covering several acres. 13-ton steel quarry cars are hauled singly from the working face to the foot of the incline by the three 7-ton Plymouth Gasoline Locomotives. The 24-ton Plymouth hauls crushed stone in 40-ton cars from a storage pile to the plant, about a half mile away.

Plymouth Locomotives are built to handle their jobs with unfaltering readiness, and are the most persistent "repeaters" on the market. A complete line of models from 2 to 60 tons, in any track gauge needed to meet your requirements. Gasoline and Diesel.

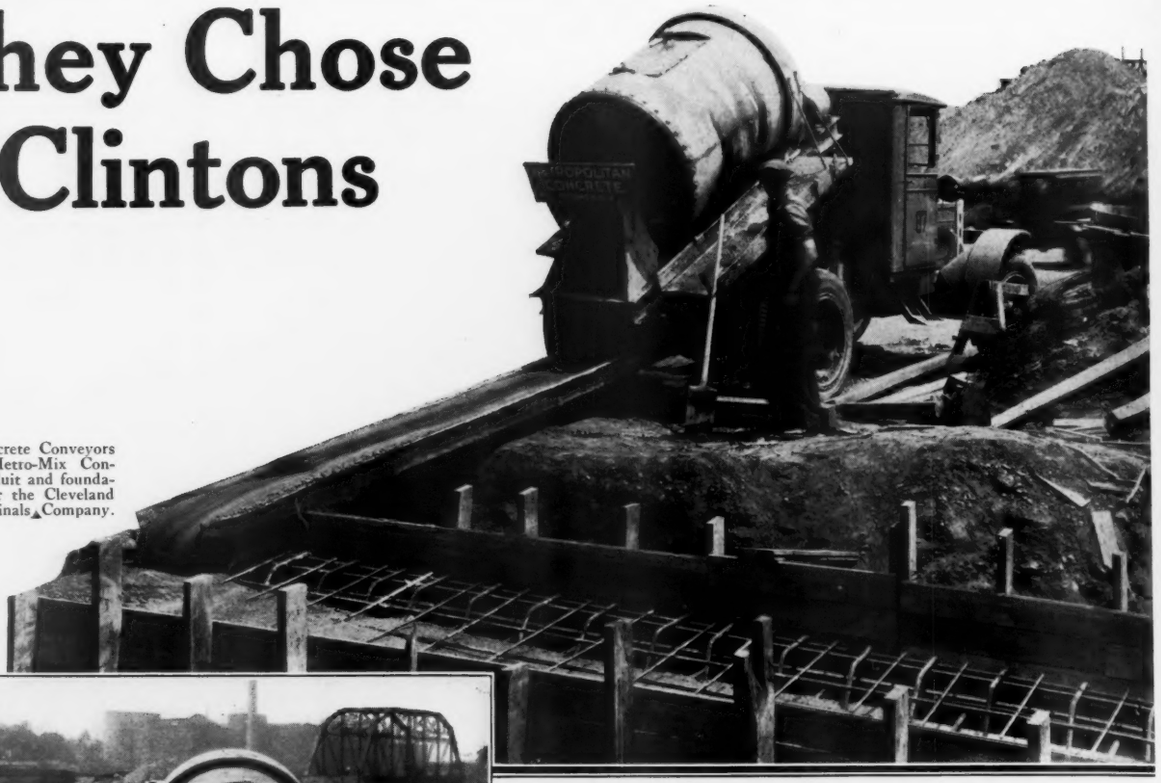
PLYMOUTH LOCOMOTIVE WORKS, PLYMOUTH, OHIO

The Fate-Root-Heath Co.



Three 7-ton Plymouths in action at the Siegfried Quarry.

They Chose Clintons



Clinton Concrete Conveyors delivering Metro-Mix Concrete to conduit and foundation jobs for the Cleveland Union Terminals Company.

THE SCIENTIFIC AGITATING CONCRETE CONVEYOR

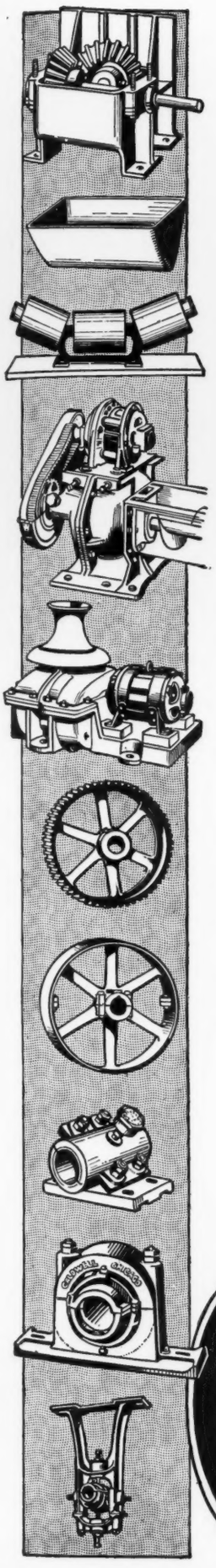
The Metropolitan Concrete Company of Cleveland, Ohio, with eight central-mixing plants and one batching plant strategically located according to railroad facilities and probable consumption needs throughout the city; is well organized to take care of the present and future requirements for transported concrete.

They are using a fleet of six 2 and 3-yard Clinton Concrete Conveyors for quick service on jobs that demand special placement conditions. A plastic and workable concrete of the consistency demanded by the job conditions is furnished in a readily controlled flow, and the price to the consumer is placed on a competitive basis with job-mixed concrete.

That Clinton Concrete Conveyors positively improve the quality of concrete, has been proved by exhaustive tests, both in the field and in the laboratory. Offered in 2 and 3 yard sizes. Can be mounted on *any* motor truck chasis.

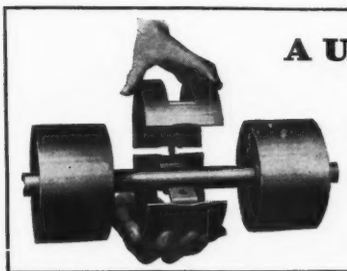
Increasing the distance that wet concrete can be hauled safely—in other words, increasing the market area available to central mixing plants—is the one sure way of increasing the income and profits of central mixing plant operators. The scientific agitation provided by Clinton Concrete Conveyors does just that. It provides a practical hauling time of three hours or better—time enough to effect deliveries over a mighty large area.

CLINTON MOTORS CORP.
Reading, Penna.



Belt Conveyors

THERE is a Caldwell Belt Conveyor Idler for every service and our large stocks enable us to make exceptionally quick deliveries. Let us figure on your belt conveyor requirements. Catalog.



A Unique Caldwell Product

The DULL Pressed-Steel Roll, illustrated, has the advantages of ease of removal, and that it will not break or rust fast to the shaft. Ask for Bulletin B-2.

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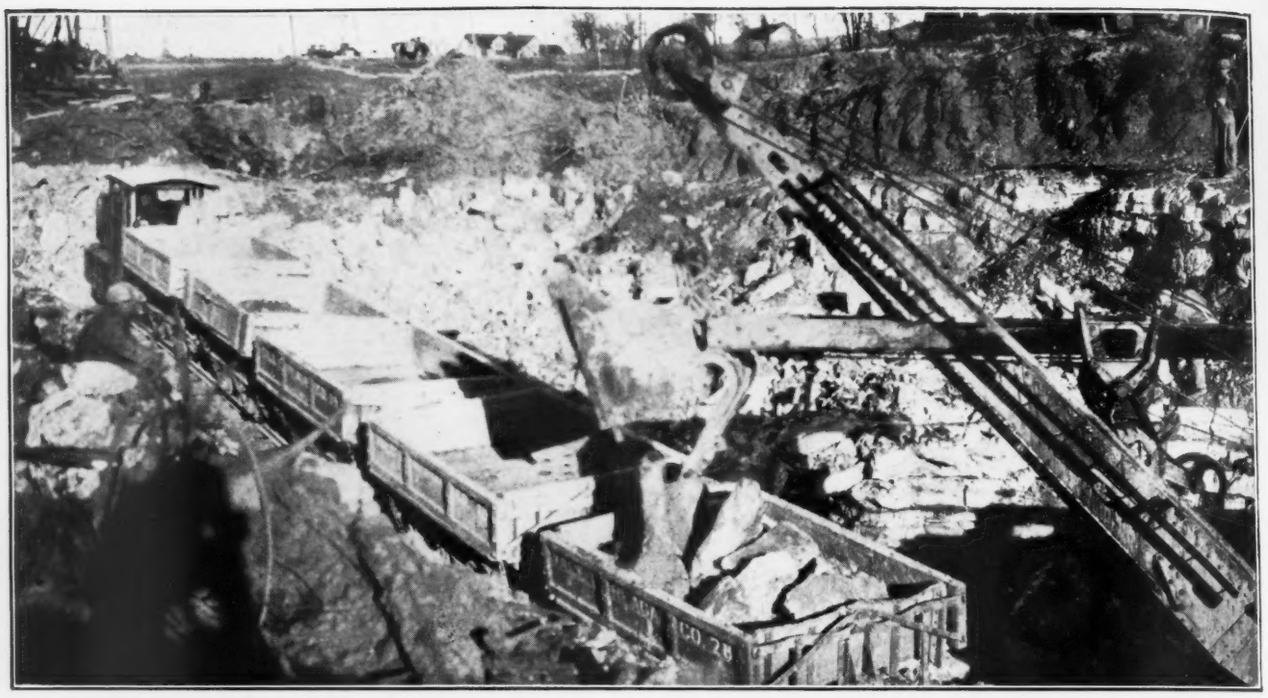
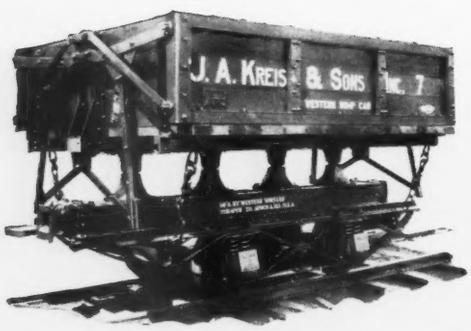
C-119

CALDWELL



Western cars handle all material with equal facility, whether overburden or quarred stone.

Western Dump Cars Make Good Wherever They Are Used



The husky Western 5-yard heavy duty dump car is used in many quarries and gravel pits.

Whether hauling dirt from a railroad cut, gravel from a pit, or stone from a quarry, Western cars are good at the job. These husky cars have the rugged strength to stand up to the hardest service.

They have flexibility, ease and speed of dumping, ability to ride rough track, and other features that speed up the work and lower the operating cost.

When you put Western cars in your plant you are getting not only cars of the latest design, carefully built of high grade material, but also are insuring your plant against the delays and expense of break-down and repair. Western cars make good wherever they are used.

Western Wheeled Scraper Company
Aurora, Illinois

WESTERN

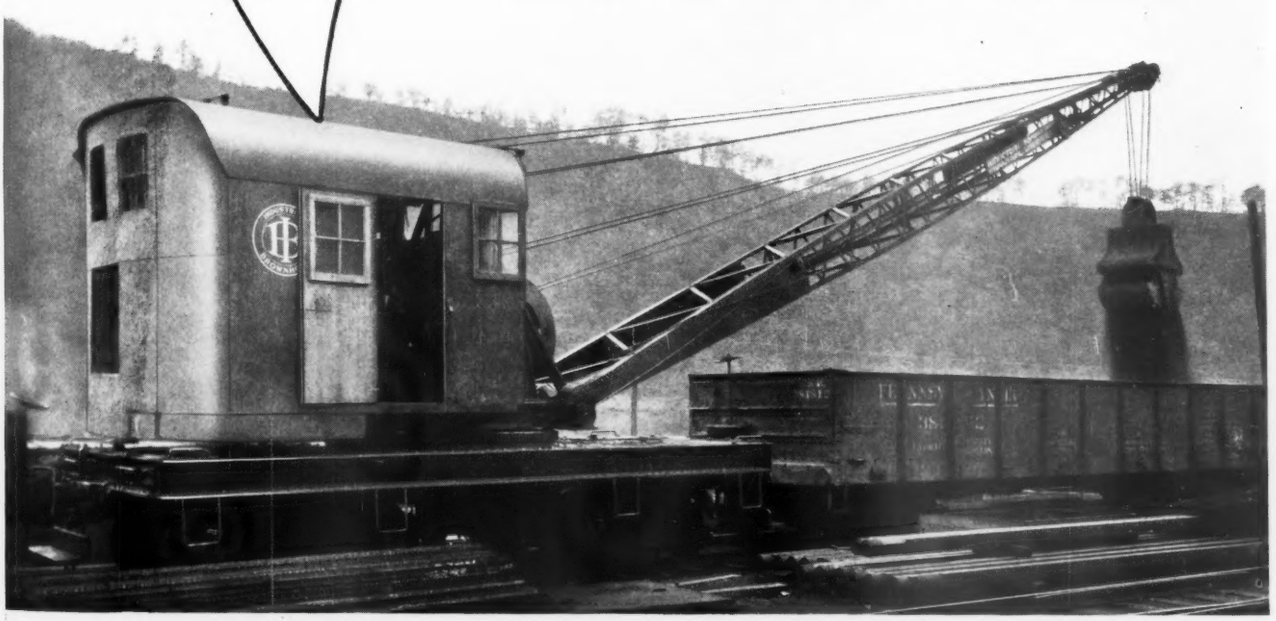
DUMP CARS AND GRADING EQUIPMENT

GAS POWER— READY INSTANTLY

Probably the most important feature of the gasoline powered locomotive crane is its instant availability. A turn of the switch .... a touch on the starter .... and the machine is ready to go to work whether it be for five minutes or a full day.

Industrial Brownhoist builds gasoline cranes ranging from 6 to 30 tons capacity and mounted on crawler, 8 or 4-wheel railroad trucks. Hundreds of users, especially those whose material handling work is intermittent, have found this type of crane an indispensable cog in their production machinery.

If you're undecided as to whether a gas crane is the type best suited to your work, get in touch with our nearby representative. He is a factory trained crane specialist and thoroughly familiar with the merits of gasoline, steam and electric power and their application to material handling problems.



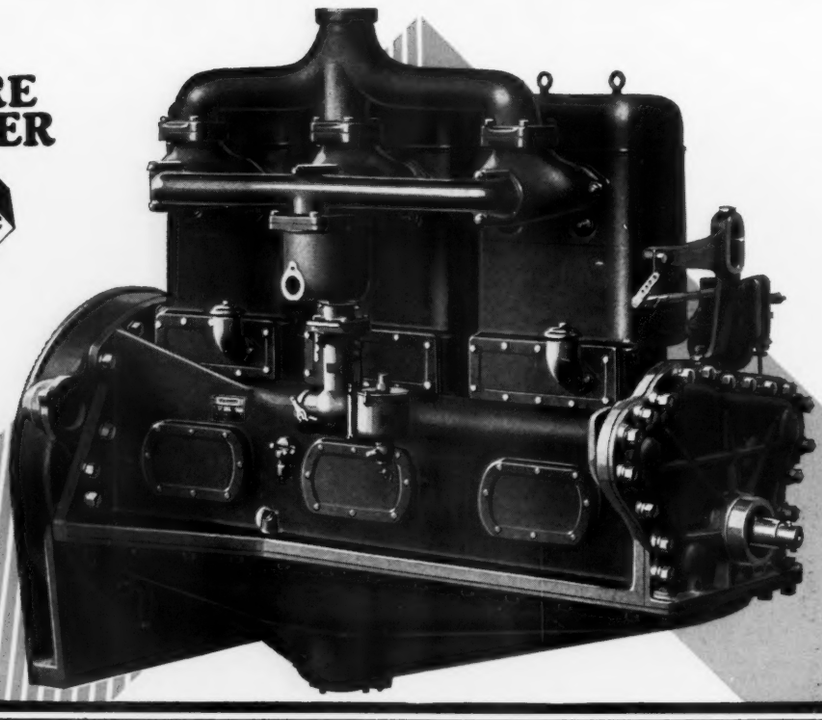
Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio

District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco, Cleveland.

Plants: Brownhoist Division, Cleveland; Industrial Division, Bay City, Michigan; Elyria Foundry Division, Elyria, Ohio.

INDUSTRIAL BROWNHOIST

MORE POWER per CUBIC INCH



Why they outsell—

PUT a Wisconsin up against the engine you now use—any engine. And the Wisconsin will sell itself every time. It has to. That's the way we do business. We send you an engine to test and test severely — and without the slightest obligation. Then when you are satisfied—when you have absolutely proved the Wisconsin better on your own work, and want to talk business, so do we.

We cordially invite you to make the test and prove the greater power per cubic inch, the flexibility, dependability, durability, and supreme economy of Wisconsin engines.

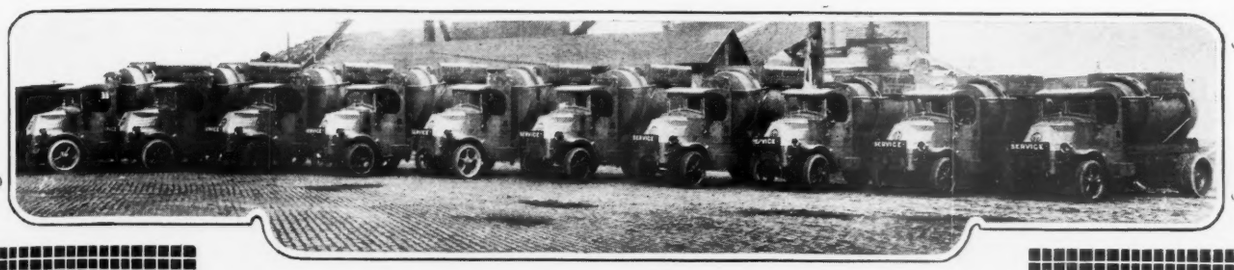
Built in a full range of Sixes and Fours, from 20 to 150 H. P., for trucks, buses, tractors, and industrial machinery.

WISCONSIN MOTOR CO.
Milwaukee
Wisconsin

See the exhibits of Wisconsin Motors and Wisconsin users—at the road show, Atlantic City, in January.

Wisconsin CONSISTENT

At Your Service



TRANSIT SYSTEM MIXED CONCRETE

In every section of the country, fleets of Paris TRANSIT Mixers are "at your service" to insure a continuous dependable supply of TRANSIT System Mixed Concrete, for every type of construction.

Architects, engineers, and contractors know that modern concrete requirements, and rigid specifications are being rapidly, efficiently and economically served by this modern system.

TRANSIT System Mixed Concrete is definitely established in the Construction Field. It is not experimental—but has a background of years of successful use under a wide variety of conditions.

Big Continuous Pours

Users of TRANSIT System Mixed Concrete enjoy the advantage of placing great quantities of concrete in a continous pour—vastly greater quantities than is possible with the limited equipment usual in building construction and without interruption to traffic in congested districts.

On Smaller Jobs, Too—

Not alone on the big spectacular jobs, but on the smaller jobs, too—TRANSIT System Mixed Concrete is rapidly coming into general use because of its established high-quality, availability and the many advantages in economical delivery and placing.

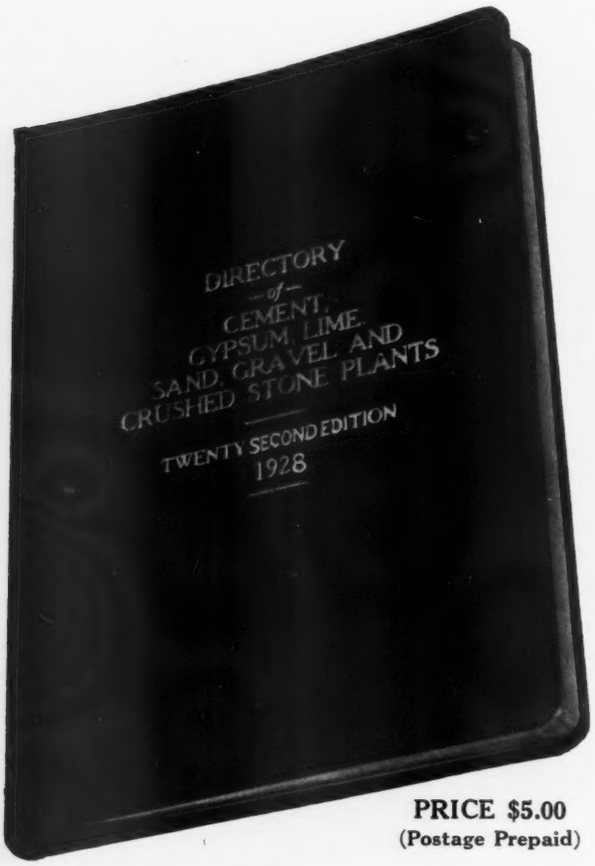
GET CONCRETE FACTS **Send for our booklet "Concrete Facts." It describes, in detail, the advantages of TRANSIT System Mixed Concrete and PARIS TRANSIT Mixers.**

Desirable operator's franchises are available in some sections.
If you desire more detailed information—write or telegraph to—

TRANSIT MIXERS, Inc.

Call Bldg., San Francisco

(Transit Mixers Canada, Ltd., Bekins Bldg., Vancouver, B. C.)



PRICE $5.00
(Postage Prepaid)

Users of this DIRECTORY

11,000 LISTINGS

of companies in the Stone Products Industry—Cement, Lime, Sand, Gravel, Crushed Stone—both alphabetically and geographically. Plant location; branch offices; executive personnel; capitalization; production.

It shows brands and trademarks; data of trade associations, their personnel, etc.; has a Buyers' Guide of Machinery and Supplies.

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Here Are a Few Concerns Taken at Random from Our Sales List:

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Haynes Stellite Co.—6
Traylor Engineering & Mfg. Co.—6
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Sandusky Cement Co.—5
Cement Information Bureau—5
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National Lime Association.
National Gypsum Institute
Portland Cement Association
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Bemis Bros. Bag Co.
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Bethlehem Steel Corp.
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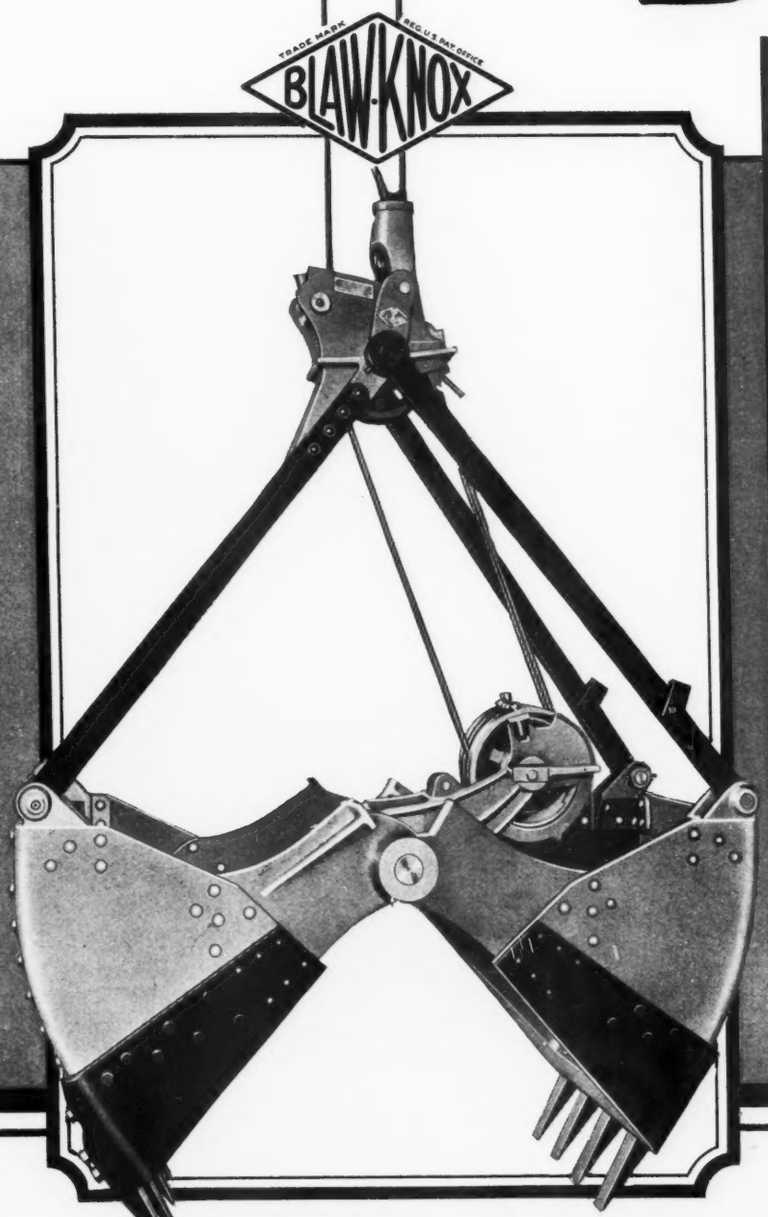

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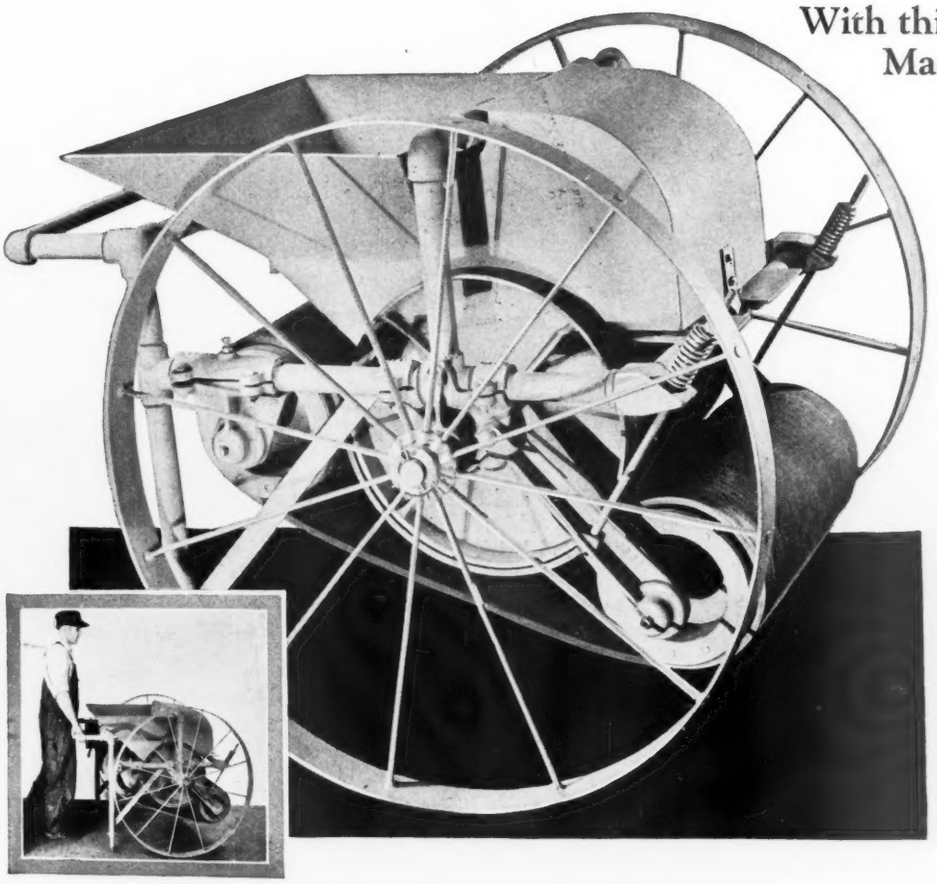

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Manufacturers' Trade Names
Equipment Catalogue, Index and Buyers' Guide
Index to Advertisers

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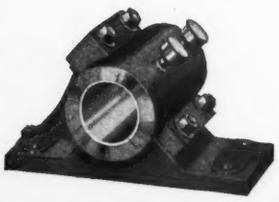
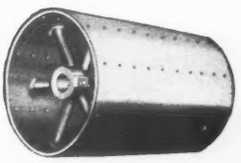


Bearings. Stock shipment can be made of practically every type of bearing required for the economical Transmission of Power.



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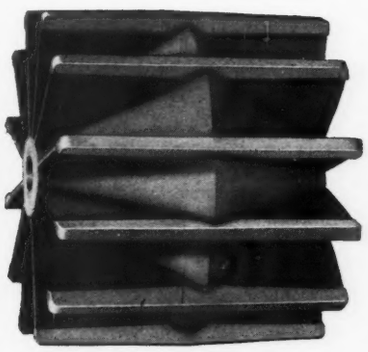
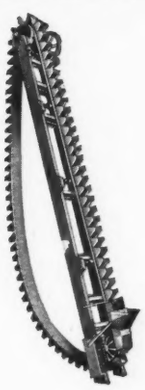


Protects Belts special cone type construction of this pulley prevents any material lodging under belt.



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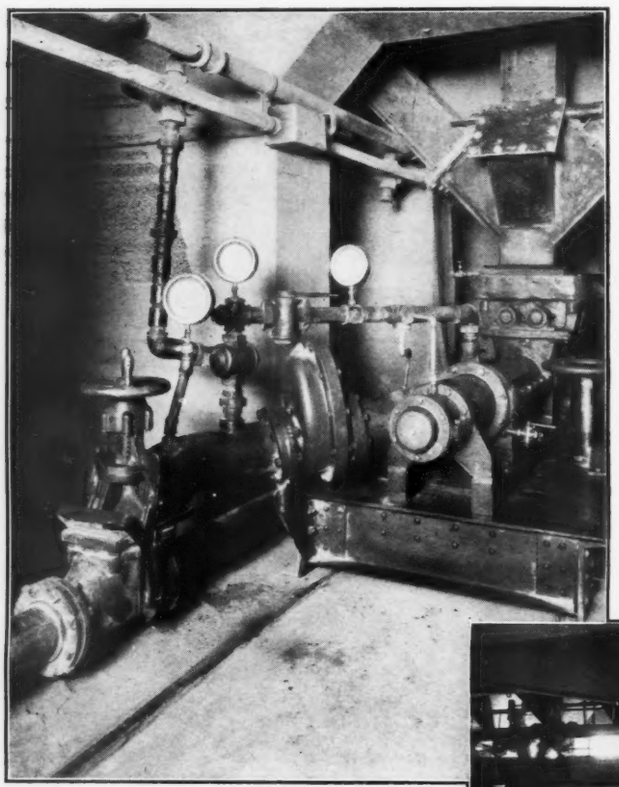
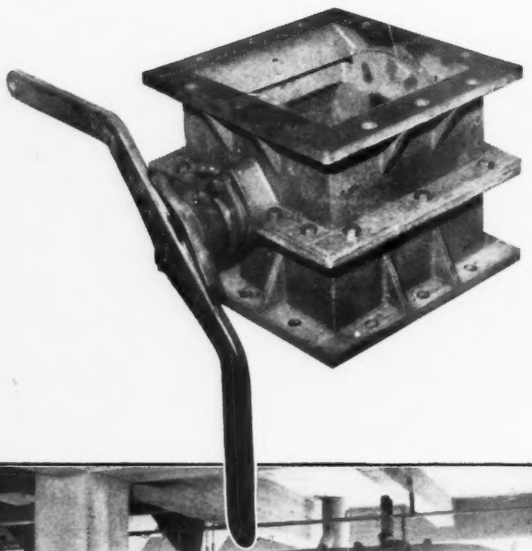
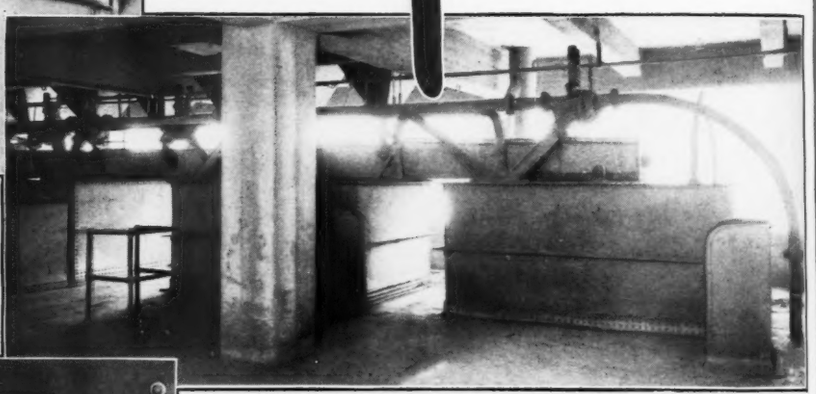


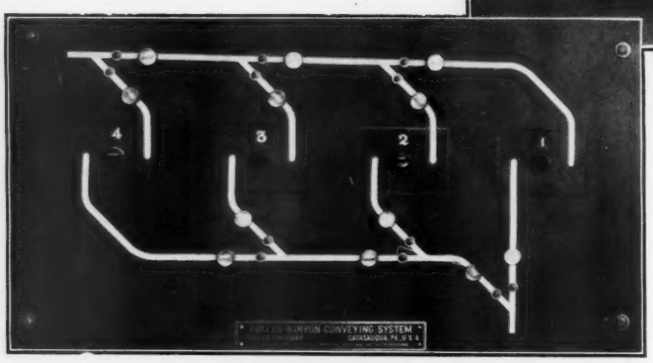
(Above) Eight-inch Portable Pump.





(Top) Fuller 14-inch rotary valve for silo discharge spouts, etc. This valve moves freely.

(Below) Control panel for two portable pumping systems, each delivering to four packer bins.



(Center) Parallel pipe lines of two systems delivering cement from silos to four packer bins. These systems operate by automatic and remote control from the panel shown on the left.

Fuller-Kinyon Portable Pumping Systems are furnished complete and ready for erection, including silo discharge spouts, rotary spout valves, transport line and valves, bin connections and complete automatic and remote control panels for operating the transport line valves of one or more systems.

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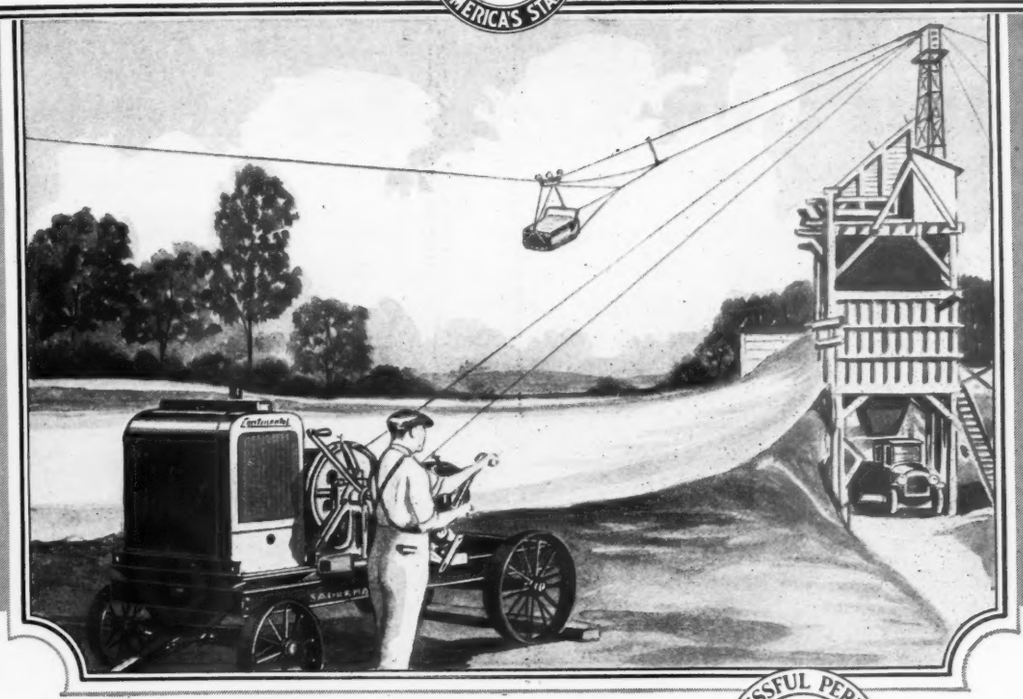

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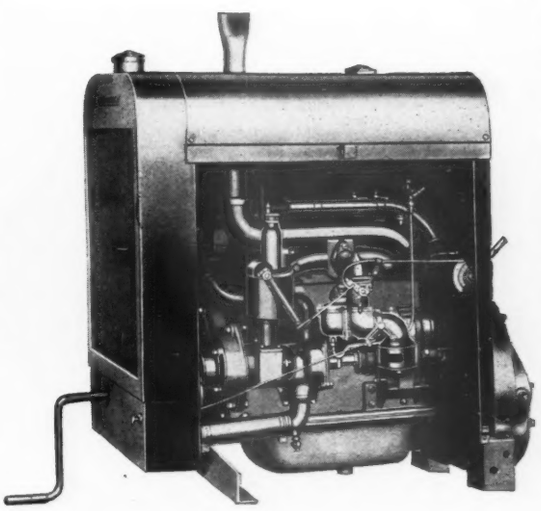

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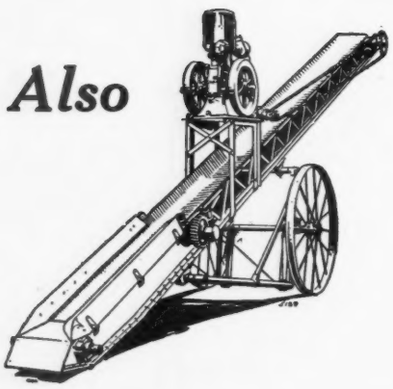

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